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ABSTRACT

As part of the test development process, this technical report is intended to present the technical aspects of the tryout and pilot stages of the Michigan High School Proficiency Test (HSPT) in mathematics. Part 1 introduces the purpose, the legislation, and the committees involved in the test development. Development of the mathematics assessment framework and the framework structures is also briefly described. Part 2 provides an overview of the exercise development of the test. Part 3 summarizes the process used in sampling, the tryout design, the rating process for constructed-response questions, reader reliability, test statistics and analyses, and other technical issues for the HSPT in mathematics tryout and pilot administrations. Part 4 contains the summary results from student and teacher surveys conducted during the tryout stage. Relevant data tables are furnished in the appendices. (ASK)

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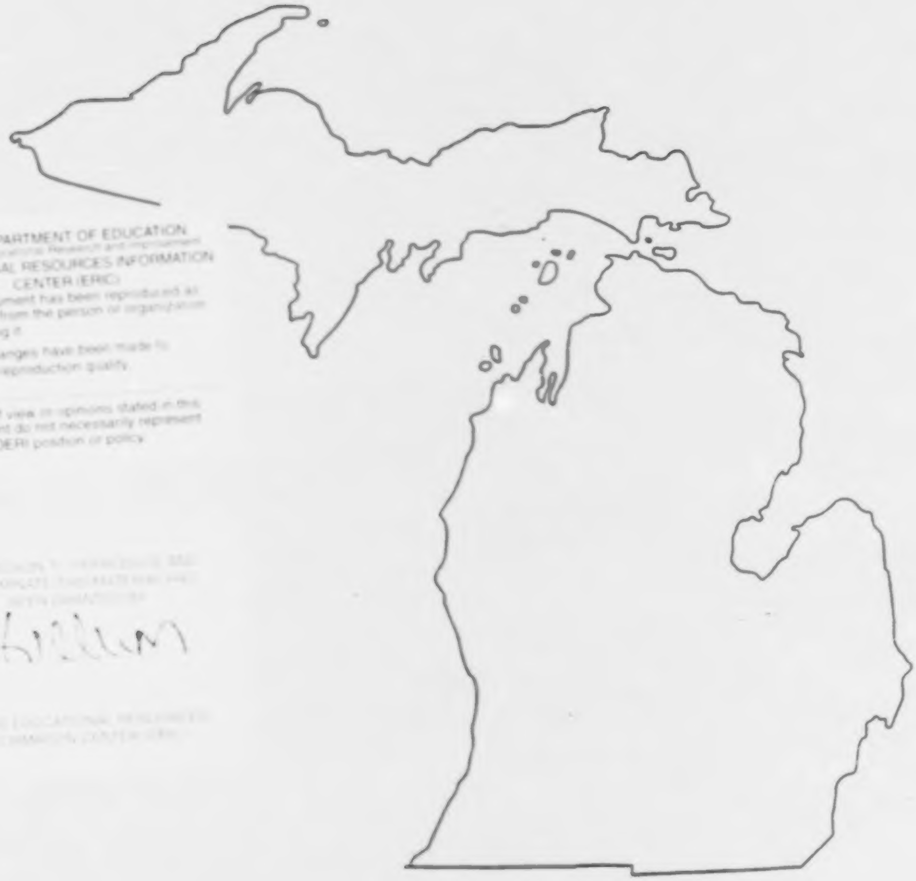
HSPT



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Tryout & Pilot Technical Report
Mathematics

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Michigan High School Proficiency Test in Mathematics
Tryout and Pilot Technical Report

Michigan Educational Assessment Program
Michigan Department of Education
November 1997

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Introduction

As part of the test development process, this technical report is intended to present the technical aspects of the tryout and the pilot stages of the Michigan High School Proficiency Test (HSPT) in Mathematics. There are four major parts to this report. Part 1, Evolution of the HSPT in Mathematics, introduces the purpose, the legislation, and the committees involved in the test development. Development of the mathematics assessment framework and the framework structures is briefly described in this part, also. Part 2 provides an overview of the exercise development of the test. Part 3 summarizes the process used in sampling, the tryout design, the rating process for constructed-response questions, reader reliability, test statistics and analyses, and other technical issues for the HSPT in Mathematics tryout and pilot administrations. Summary results from student and teacher surveys conducted during the tryout stage are included in Part 4. The relevant data tables are furnished in the appendices. Operational technical reports will follow a similar format.

Part 1. Evolution of the HSPT in Mathematics

The Purpose of the Michigan High School Proficiency Test

As required by law, The Michigan High School Proficiency Test (HSPT) was developed to provide students with an opportunity to earn state endorsement of the local diploma. Public Act 118 (P.A. 118) of 1991, Section 104(a)(subsection 7) of the School Aid Act states:

> Not later than July 31, 1993, the department shall develop and the state shall approve assessment instruments to determine pupil proficiency in communication arts, mathematics, science and other subject areas specified by the state board. The assessment instruments shall be based on the state board model core curriculum outcomes. Beginning with the graduating class of 1997, a pupil shall not receive a high school diploma unless the pupil achieves passing scores on the assessment instruments developed under this section.

The legislation initiating the development of the HSPT was introduced to respond to educators' and employers' concern that Michigan students were leaving high school without the knowledge and skills necessary to lead productive lives. Additionally, the high school diploma was awarded on the basis of local requirements. There was no consistency from school to school, nor were there, with the exception of one semester's instruction in civics, state requirements for receiving a high school diploma. The HSPT provides a consistent measure of what students should know and be able to do at the end of the tenth grade in Michigan schools.

The Expert Panel

The Expert Panel on the Michigan High School Graduation Test was convened to advise the Michigan State Board of Education on important issues surrounding the high school proficiency examination enacted by P.A. 118 of 1991. The panel consisted of national experts with first-hand knowledge and experience in large scale testing programs (see Appendix A for list of Expert Panel members).

The Expert Panel met over three days in February and March of 1992 to examine the educational, technical, legal, fiscal and logistical issues relating to competency testing and the steps to be taken in the implementation of P.A. 118. Its report "Issues and Recommendations Regarding Implementation of the Michigan High School Graduation Tests" was issued in April of 1992. The report included 51 recommendations and rationale for each of the recommendations (see Appendix A).

Legislation Change

Between the issuance of the Expert Panel Report and the development of the Assessment Frameworks for each of the content areas tested by the HSPT, new legislation was passed which dramatically changed the intent of the test. Whereas P.A. 118 had stated that the awarding and denying of high school diplomas would be determined by HSPT scores, Public Act 335 of 1993 softened the intent of the test. P.A. 335, Section 1279 states that the HSPT would be used to award state endorsements of the local high school diploma:

> Beginning with pupils scheduled to graduate in 1997, if a pupil achieves the academic outcomes required by the state board, as measured by an assessment instrument developed under subsection (8), for a state-endorsed high school diploma in 1 or more of the subject areas of communications skills, mathematics, science, and, beginning with pupils scheduled to graduate in 1999, social studies, the pupil's school district shall award a state endorsement on the pupil's diploma in each of the subject areas in which the pupil demonstrated the required proficiency. A school district shall not award a state endorsement to a pupil unless the pupil meets the applicable requirements for the endorsement, as described in this subsection. A school district may award a high school diploma to a pupil who successfully completes local district requirements established in accordance with state law for high school graduation, regardless of whether the pupil is eligible for any state endorsement... The assessment instruments shall be based on the state board model core academic curriculum outcomes...

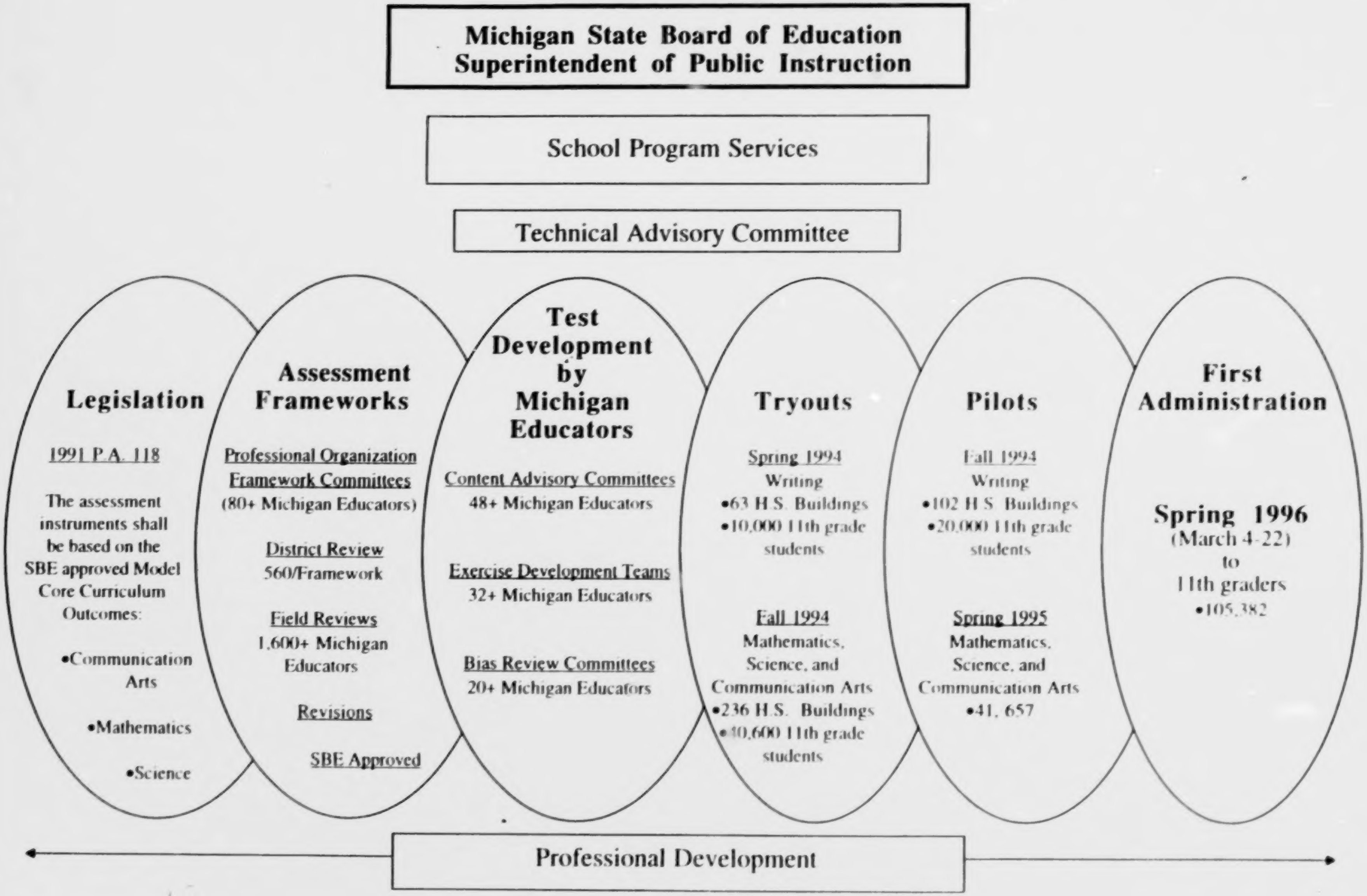
The change in the law also changed the context in which the Expert Panel Recommendations were considered in the development of the HSPT. In addition to the Expert Panel Report, several policy decisions and subsequent policy actions shaped the development of the HSPT from the onset.

- The HSPT would align with the Michigan Model Core Curriculum Outcomes (State Board of Education, 1991), broad outcomes to be achieved by all students as a result of their school experiences. Fundamental to the Model Core Curriculum is the belief that the ultimate purpose of education is to permit each individual student to reach his or her optimum potential, to lead a productive and satisfying life (The Common Goals of Michigan Education, 1980).
- The HSPT would establish high expectations for all students.
- The HSPT would focus on the application of knowledge, problem solving and critical thinking.
- The HSPT would assess what students should know and be able to do by the end of tenth grade.
- Recognizing that what gets tested, gets taught, the HSPT would, to the extent possible in large scale assessment, model good instructional practice.

Students earning proficient scores on the Michigan High School Proficiency Test in mathematics, science, writing and reading earn the state endorsement of the local diploma in mathematics, science and communication arts.

Table 1 and Figure 1 show the timeline and the process used by the Michigan Department of Education Michigan Educational Assessment Program (MEAP) for the development of the HSPT.

Figure 1. HSPT Development Process



Michigan State Board of Education
Superintendent of Public Instruction

School Program Services

Technical Advisory Committee

Legislation

1991 P.A. 118

The assessment instruments shall be based on the SBE approved Model Core Curriculum Outcomes:

- Communication Arts
- Mathematics
- Science

Assessment Frameworks

Professional Organization Framework Committees
(80+ Michigan Educators)

District Review
560/Framework

Field Reviews
1,600+ Michigan Educators

Revisions

SBE Approved

Test Development by Michigan Educators

Content Advisory Committees
48+ Michigan Educators

Exercise Development Teams
32+ Michigan Educators

Bias Review Committees
20+ Michigan Educators

Tryouts

Spring 1994
Writing
- 63 H.S. Buildings
- 10,000 11th grade students

Fall 1994
Mathematics, Science, and Communication Arts
- 236 H.S. Buildings
- 40,600 11th grade students

Pilots

Fall 1994
Writing
- 102 H.S. Buildings
- 20,000 11th grade students

Spring 1995
Mathematics, Science, and Communication Arts
- 41, 657

First Administration

Spring 1996
(March 4-22)
to
11th graders
- 105,382

Professional Development

Table 1. HSPT Development Timeline

High School Proficiency Test
Timeline 1992-1997
Mathematics, Science, Reading, Writing

1992-1993	**Define Test Frameworks**
November 2, 1992	Met with MRA, MSTA, MCTM and MCTE to discuss Frameworks development
January 8, 1993	Proposals to Michigan Department of Education
February, 1993	Input: Preliminary Field Review by Professional Organizations
March 31, 1993	Frameworks due to Michigan Department of Education
April 21, 1993	Michigan State Board of Education receives Frameworks
April 21 - May 31, 1993	Field Review and Comments
Summer, 1993	State Board of Education Approves Frameworks
1993, 1994, 1995	**Test Development**
Summer 1993	Issued RFPs
November 1993	Item/Exercise Development-Writing Test
January 1994	Item/Exercise Development-Mathematics, Science, Reading
April 1994	Tryouts-Writing Scoring, Analysis and Revision
November 1994	Pilots-Writing Scoring and Analysis
November 1994	Tryouts-Mathematics, Science, Reading Scoring, Analysis and Revision
April 1995	Pilots-Mathematics, Science, Reading Scoring, Analysis
1996-1997	**Test Administration Timeline**
Spring 1996	Test Administration
Fall 1996	Retest
Spring 1997	Test/Retest Award Endorsements Based Upon Results

Committees Involved in the Development of the Michigan High School Proficiency Test (HSPT)

The Technical Advisory Committee (TAC)

After the Expert Panel submitted its recommendations for implementing the HSPT, a subset of six core panel members was selected to form the Technical Advisory Committee (TAC) to serve in an advisory capacity during test development and implementation. Additional membership has been determined on an ad hoc basis based upon a need for particular expertise. The TAC has met with Michigan Educational Assessment Program (MEAP) staff four times or more a year to provide continuous advice on technical, policy and legal issues related to the MEAP tests.

Prior to the first meeting, each TAC member received executive summaries of the assessment frameworks in mathematics, science, reading and writing; and portions of the proposal submitted by CTB/McGraw-Hill, the vendor chosen to coordinate item development for mathematics, science and reading. The TAC played an active role throughout test development and standard setting: shaping and reviewing plans, advising staff on the appropriate analyses to require of contractors and reviewing analyses provided. The TAC has been intimately involved in the program at every step and continues to be involved.

The Exercise Development Team (EDT)

The Exercise Development Team for Mathematics was made up of seven Michigan teachers who were nominated by MDE Curriculum and MEAP staff. Members of the EDT signed a contract before item writing began. The committee members were responsible for writing all of the HSPT in Mathematics items. All members received item writing training from CTB/McGraw-Hill. More information about exercise development for the HSPT is contained in a later section of this manual.

The Content Advisory Committee (CAC)

The Content Advisory Committee for Mathematics was responsible for the integrity of the HSPT in Mathematics. The CAC reviewed each test item to ensure that it was appropriately related to the Model Core Curriculum Outcomes and the Michigan Essential Goals and Objectives in Mathematics, as set out in the legislation. Both of these documents were approved by the State Board of Education and disseminated to school districts well in advance of the first administration of the HSPT in the spring of 1996. Items were evaluated for consistency with the criteria set out in the Assessment Framework and appropriateness for measuring proficiency in mathematics for all students by the end of tenth grade. The CAC reviewed every test form to check for a reasonable distribution of item difficulty and for an adequate sample of the content area. Items were rejected or revised based upon decisions made by the Content Advisory Committees.

The CAC for Mathematics was originally made up of fourteen members including high school and middle school classroom teachers, district and school mathematics department chairpersons, college mathematics instructors and the mathematics consultant from the Curriculum Development Unit of MDE.

The Bias Review Committee (BRC)

The first Bias Review Committee was comprised of eleven members from the Michigan Department of Education and several Michigan school districts. School district personnel ranged from administrators to content area consultants to English as a Second Language (ESL) coordinators and classroom teachers. BRC members reviewed every HSPT test item for possible bias to gender, racial or ethnic groups; religious groups; socioeconomic groups; persons with disabilities; older ages; and for regional concerns. In instances where the BRC observed bias, the BRC was responsible for providing suggestions that made the test material as bias-free as possible, but did not distort or interfere with test content.

Lists of members of the above committees are in Appendix A.

Developing the Assessment Frameworks to Guide the Development of the HSPT in Mathematics

The Assessment Frameworks were structured to guide the test development process for the HSPT in Mathematics. The Michigan Council of Teachers of Mathematics (MCTM) viewed the development of the frameworks document as a means for advancing mathematics education in Michigan to further align mathematics instruction to the National Council of Teachers of Mathematics (NCTM) standards.

From January to mid-March 1993, the following Frameworks development activities took place:

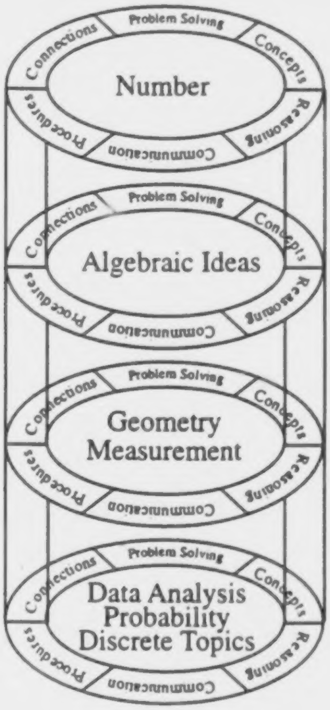
- Two major committees were formed: 1) the Frameworks Steering Committee, consisting of 11 people who agreed to be responsible for the writing of the curriculum framework, the assessment frameworks, assessment specifications and sample assessment items; and 2) the Frameworks Management Committee, consisting of 35 members who were responsible for reviewing documents at key periods in the production.
- The Frameworks Steering and Management Committees were composed of business representatives, school administrators, teachers, consultants, university mathematicians and mathematics educators. An ethnically diverse membership represented urban, suburban and rural communities from across the state.
- The Management Committee reviewed the initial draft document and suggested modifications.
- Approximately 300 mathematics educators reviewed the draft framework at the University of Michigan Mathematics Education Leadership Conference.
- The draft document, containing frameworks and sample items, was reviewed at the following sites across the state: Ann Arbor, Grand Rapids, Sault Ste. Marie, Battle Creek, Lansing, Tawas, Detroit, Mt. Clemens, Traverse City, and Flint. The 530 participants included general, special, and adult education teachers; principals; superintendents; and curriculum specialists.
- The Steering Committee rewrote the frameworks, the sample items and the item specifications based upon the responses obtained in the field reviews.
- The Management Committee met in mid-March for final review of the Frameworks document.

On April 21, 1993, the Michigan State Board of Education received the Assessment Frameworks for the Michigan High School Proficiency Test in Mathematics and authorized the Superintendent of Public Instruction to disseminate the Frameworks to every school district in the state for a second round of field reviews and comments.

Structure of the Mathematics Frameworks

There are two parts to the Assessment Frameworks for the Michigan High School Proficiency Test in Mathematics: a curriculum framework and an assessment framework. The Frameworks describe what mathematics students can be expected to do by the end of tenth grade, the assessment plan for the examination, and task specifications for item writing. The curriculum framework serves as the basis for the assessment framework. The assessment framework spells out general assessment specifications, item specifications for each content strand, and outcomes within a strand. This section is adapted from the Frameworks of the HSPT in Mathematics (p. 4 through p. 8).

Figure 2. Pattern and Relationships of Mathematics Characteristics and Content Domains



"Patterns and Relationships" is the connecting theme for each of the elements of the framework model (Figure 2), which includes:

- six mathematics characteristics (i.e.; communication; problem solving; connections; reasoning; procedures; concepts) and
- four content domains (i.e.; number; algebraic ideas; geometry, measurement, and trigonometry; and data analysis, probability, and discrete topics).

The model illustrates the interrelationship among the four mathematical content domains and six mathematical characteristics. The position of the domains within the diagram does not indicate any intended sequence or order of importance. The explanations of content strands are as follows:

Number - students have concepts and procedures for number, operations on numbers, and proportional reasoning, and use these concepts and procedures to pose and to solve real-world and mathematical problems.

Algebraic Ideas - students can represent and solve problems physically, graphically, verbally, and symbolically.

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Geometry, Measurement, Trigonometry - students measure, build, draw, visualize, use informal methods to solve geometric problems and generalize. Students make valid deductions from a given set of information and use characteristics and relationships among shapes.

Data Analysis, Probability, Discrete Topics - students will use methods of data collection and analysis, statistical and probability experiments, and discrete models to solve problems and answer real-world questions.

Issues Raised During the Development of the Mathematics Frameworks

During the development of the Mathematics Frameworks, there were concerns raised regarding the ability of school districts to provide adequate instruction in certain content strands for reasons related to teacher readiness, curriculum development and/or the availability of hands-on materials (texts, calculators, computers, etc.). The content in question is: matrices, trigonometry, discrete topics, spreadsheets, and certain probability and statistics concepts which were not previously tested on MEAP. Consequently, this content was not included in the plans for the 1996-2000 test forms.

The following questions were raised during the writing of the Mathematics Frameworks:

1. To what extent have the Model Core Curriculum Outcomes, upon which the content of the HSPT is based, been implemented?

- In October, 1994, MDE conducted a Student Survey and a Teacher Survey. Details of the surveys and their results are delineated in Part 4 of this report.

2. Are the two new areas, Trigonometric Ratios and Discrete Topics, consistent with what is currently being taught? Are they appropriate for inclusion in the assessment at a later date?

- These topics were not included in the Spring 1996 version of the HSPT in Mathematics. However, they will be included in the future administrations.

3. When will graphing calculators and other modern technology, available to many students inside and outside of school and accessible in business, be available for student use on the assessment?

- In districts that provide Mathematics instructions using calculators, students are encouraged to use calculators. No questions in the test are dependent upon any particular calculator. Also, no questions in the test require a calculator (p. 30. HSPT Administration Manual, 1996).

Another critical issue in any test development is that while the assessment must be consistent with the instruction that students have received, it must also be evolutionary to keep pace with changing societal demands on education. With these demands, curriculum changes and assessment then must change to measure the effectiveness of curriculum delivery to students. It is also necessary to provide assessment tasks that students can realistically accomplish through experiences in school. As such, assessments must be instructionally sensitive. Otherwise, they are likely to be meaningless as measures of school-based learning.

Therefore, it was necessary to balance the development of the HSPT between three forces: what was needed to advance the mathematics curriculum as established in the NCTM standards, previous opportunities to learn, and the currently existing levels of instruction to deliver the mathematics curriculum.

The framework is consistent with the Model Core Curriculum Outcomes and national standards. The extent to which all of the framework recommendations could justifiably be incorporated in a first test was determined by studying existing curriculum and technology use within the classroom.

Part 2. Exercise Development for the HSPT in Mathematics

A major portion of the work in the Michigan Educational Assessment Program has been done contractually. Through the Department of Budget and Office of Purchasing, the Department of Education issues a Request for Proposals (RFP) describing the Department's testing requirements. The successful bidder must meet both quality and cost criteria as part of the evaluation process.

In order to meet the tight timeline required by legislation for development of the HSPT, CTB MacMillan/McGraw-Hill was hired to coordinate the exercise development process for the HSPT in mathematics, reading and science. CTB has years of experience in test development for national achievement tests, as well as for state assessment programs. For the HSPT, with direction from MDE Curriculum and MEAP staff, CTB provided training for the Exercise Development Team (EDT) and facilitated the EDT meetings. In addition, CTB developed the initial mathematics item bank and test forms and ran item analyses on the tryouts and pilot tests. The CTB contract ran through the initial pilot process.

In early 1994, notebooks were sent to all committee members of the EDT to use as a resource during the development process. The notebooks, called "The Michigan Exercise Development Guideline for Mathematics," contained an overall schedule for exercise development and an outline of the scope of work and specific tasks for each writer. The guidelines included general item specifications and criteria for writing and editing multiple-choice and constructed-response items and for writing rubrics for the constructed-response items. The EDT completed item development by June of 1994. General item specifications used by the mathematics EDT follow. Detailed specifications for each content area are contained in the Mathematics Frameworks.

General Item Specifications

1. It is preferable that items assess multiple outcomes within or across strands as well as multiple characteristics of the outcomes. The items should provide a balance among communication, problem solving, connections, reasoning, procedures and concepts. No items should be purely computational.

2. It is preferable that items cause students to apply generalizable knowledge, solve problems, reason through situations, make connections between ideas, and communicate mathematically.

3. All items should be presented in a setting appropriate to the age level and background of the students.

4. When possible, problems should be presented in a real-world setting.

5. The question introduced by the item should be stated clearly and unambiguously. The reading level should be appropriate for the low ability spectrum of the age group.

6. Alternative responses (distracters/foils) to multiple-choice items should relate to a common context. Each alternative response should be a believable answer for someone who does not really know the correct answer. Alternative responses should be presented in a logical order. Options like "all of the above" or "none of the above" should not be used.

7. All multiple-choice items will have four answer choices (A, B, C, D). The general layout of the item should promote comprehension of the item/question.

In items using diagrams, it is appropriate for:
illustrations to be uncluttered and unambiguous in what is depicted.
illustrations to contain only relevant items.

It is inappropriate to use diagrams:
which introduce bias to the item.
which are used just for the sake of illustration.

8. Indicate the correct response by putting an asterisk (*) next to it.

9. Indicate rationale for distracters when appropriate (especially computational responses).

General Guidelines For Constructed-Response Items

1. Item should assess targeted outcome(s).

2. An item may assess more than one strand, but all strands should be identified.

3. Items should be grade-appropriate.

4. Items should be free of content bias or stereotyping.

5. All information in the items, examples and rubrics must be accurate.

6. Items must be grammatically correct.

7. Each item must clearly and unambiguously elicit the desired response.

8. Each item must be scorable with a specified rubric or scoring tool; that is, the range of possible correct responses must be wide enough to allow for diversity of responses but narrow enough to ensure that students who do not possess the skill being assessed cannot obtain the maximum score.

9. Items should be clear and concise, utilizing simple vocabulary and sentence structure.

10. Words or phrases requiring emphasis should be underlined.

11. If negative words (such as no or not) must be used, they should be underlined. Do not use any double negatives.

12. The selected item format must be appropriate for the question being asked and the response being elicited (e.g., do not ask students to draw pictures of abstract ideas).

13. All item art is clearly described and a sketch is provided.

14. Items should not depend on prior knowledge unless that is the skill being assessed.

Part 3. HSPT in Mathematics Tryout and Pilot

After the Exercise Development Teams completed items for each content area to be tested on the HSPT, the Content Advisory Committees and the Bias Review committee reviewed all items. Tryouts were scheduled for the items that survived this initial committee review. Statistical data from the tryouts and pilots is part of the information used to determine which items merit further consideration for use on "live" or operational tests. In addition, participating teachers are asked to return comment sheets describing problems with the directions and/or items and noting administration details, such as the amount of time it took the majority of students to complete the test. Comments from teachers are particularly helpful in making decisions about items and test forms (see Appendix B for a sample.)

Sample Design and Characteristics

Data for the HSPT in Mathematics tryout and pilot were collected using the same procedures. To ensure representativeness, cluster sampling combined with stratification was used to sample from Michigan public schools. Michigan schools are classified into seven strata by resident population size of the community where the school is located (see Appendix A for stratum classifications). Schools participating in the tryouts were randomly sampled from each stratum roughly proportional to the population proportions. The number of sampled schools in the mathematics tryout by stratum is listed in Table 2 below.

Table 2. Number of Sampled Schools in the Michigan HSPT in Mathematics Tryout by Stratum

Stratum	# of Schools Sampled	Total # of Schools in the Stratum	% of Stratum
1	6	49	12.2%
2	6	64	9.4%
3	9	106	8.5%
4	6	62	9.7%
5	1	7	14.3%
6	23	232	9.9%
7	22	218	10.1%
undefined[1]	7	NA	NA
Total	80	738	--

The sampled schools were considered representative of Michigan student population in gender, ethnicity, and school size. Distributions by gender and ethnic groups for the mathematics tryout by test form are shown in Tables 3 and 4.

Schools participating in the tryout were not sampled again for the pilot. Schools that were sampled for the tryout or pilot but did not participate were replaced by schools with similar characteristics to keep the representativeness of the sample. Also, schools participating in the mathematics tryout or pilot were not selected in the reading or science tryouts and pilots.

---

[1] These schools were either alternative or adult high schools.

Table 3. Distribution of Students by Gender in the HSPT in Mathematics Tryout by Form

Form	Total # of Students Tested	# of Males	# of Females
11	1056	516	540
12	1045	461	584
13	1196	547	649
14	1200	559	641
15	1107	517	590
16	1099	523	576
17	1146	560	586
18	1237	622	615
19	1101	526	575
Total	10187	4831	5356

Table 4. Distribution of Students by Ethnicity in the HSPT in Mathematics Tryout by Form

Form	# of Students Tested	Am. Indian N (%)	Asian N (%)	Black N (%)	Hispanic N (%)	White N (%)	Multi-racial N (%)	Other N (%)
11	1056	15 (1.4)	21 (2.0)	106 (10.0)	34 (3.2)	789 (74.7)	35 (3.3)	56 (5.3)
12	1045	14 (1.3)	25 (2.4)	122 (11.7)	32 (3.1)	760 (72.7)	33 (3.2)	59 (5.7)
13	1196	18 (1.5)	13 (1.1)	183 (15.3)	31 (2.6)	840 (70.2)	31 (2.6)	80 (6.7)
14	1200	14 (1.2)	27 (2.3)	189 (15.8)	21 (1.8)	839 (69.9)	34 (2.8)	76 (6.3)
15	1107	11 (1.0)	14 (1.3)	246 (22.2)	15 (1.4)	753 (68.0)	27 (2.4)	41 (3.7)
16	1099	18 (1.6)	43 (3.9)	158 (14.4)	13 (1.2)	775 (70.5)	32 (2.9)	60 (5.5)
17	1146	17 (1.5)	29 (2.5)	100 (8.7)	23 (2.0)	903 (78.8)	35 (3.1)	39 (3.4)
18	1237	14 (1.1)	31 (2.5)	69 (5.6)	37 (3.0)	969 (78.3)	41 (3.3)	76 (6.2)
19	1101	16 (1.5)	8 (0.7)	83 (7.5)	27 (2.5)	873 (79.3)	39 (3.5)	55 (5.0)
Total	10187	137 (1.3)	211 (2.1)	1256 (12.3)	233 (2.3)	7501 (73.6)	307 (3.0)	542 (5.3)

Tryout Test Design

There were 9 tryout forms in mathematics. Each form was made up of 40 multiple-choice items and seven constructed-response or constructed-response items (see Table 5 below).

Table 5. Configuration of the HSPT in Mathematics

Item Distribution	Content Strands			
	Number	Algebraic Ideas	Geometry /Measurement	Data Analysis /Probability
# of Multiple-Choice Items	10	10	10	10
# of Constructed-Response Items	7			

The Mathematics tryouts involved 10,187 students in grade 11 during the late fall of 1994. Each student took one tryout form. Forms were divided into triplets. The forms within each triplet were administered to randomly equivalent groups created by spiraling forms over students within classrooms. This design permitted the equating of forms within triplets through the assumption of randomly equivalent groups. An alternative design of spiraling all forms within schools was not used because of security concerns about all forms being exposed in a school. In addition, there were forms in common between triplets. Forms in different triplets were equated by use of the Stocking and Lord (1983) procedure applied to the items in the common form. The following table displays the forms composition for the HSPT in Mathematics tryout:

Table 6. Tryout Form Composition for the HSPT in Mathematics

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Form 11	Form 13	Form 15	Form 17	Form 19	Form 14
Form 12	Form 14	Form 16	Form 18	Form 11	Form 16
Form 13	Form 15	Form 17	Form 19	Form 12	Form 18

Rating Process for Constructed-Response Items

All multiple-choice items were machine-scored. All constructed-response items were hand-scored by two readers. Readers were trained to implement the Michigan scoring guides. Anchor papers, check sets, and read-behinds were employed. For all constructed-response items, if the two readers disagreed by more than one point, a third reading was obtained. This situation rarely occurred. If two readings were sufficient, the item score was the sum of the two readings. If three readings were required, the item score was the sum of the three readings multiplied by 2/3, and rounded to the nearest integer. This process provided constructed-response items with 5, 7, 9, or 11 score levels in Mathematics.

Reader Reliability

Indices of reader reliability, in the form of ranges of exact agreement and consistency, are presented by form in Table 7 below. Agreement, calculated for each reader, is defined as the percent of times that the first reader agreed exactly with the second reader:

$$\text{Agreement} = \frac{\text{N Exact Agreement with Second Reader}}{\text{N Second Reads}} \times 100 \qquad (1)$$

The agreement range describes the lowest and highest agreement rates seen among all readers. Consistency is defined as the percent of times the first reader agreed exactly with the second reader or the third reader:

$$\text{Consistency} = \frac{\text{N Exact Agreement with Second or Third Reader}}{\text{N Total Reads}} \times 100 \quad (2)$$

The consistency range spans the readers who had the smallest and largest consistency rates. Consistency rates must be at least as large as agreement rates.

Both agreement and consistency ranges were generally small in width for the HSPT in Mathematics tryout, with upper bounds that were often at 100%. Only one form, Form 17, in mathematics had an agreement range (79%) that dipped below 92%, due to one reader who completed only 14 readings, compared to an average of hundreds of readings for the remaining readers.

Table 7. Agreement Ranges for the HSPT in Mathematics Tryout

FORM NUMBER	AGREEMENT RANGE	CONSISTENCY RANGE
11	96 - 100%	97 - 100%
12	94 -99	95 - 99
13	95 - 100	97 - 100
14	94 - 100	95 - 100
15	96 - 100	97 - 100
16	96 - 99	96 - 100
17	79 - 97	92 - 98
18	94 - 100	95 - 100
19	95 - 99	96 - 99

Tryout Statistics and Analyses[2]

Item Difficulty

Ranges of item difficulty (p-values) and item test correlations are presented in Table 8 (Appendix B). Rather than presenting the full range, which usually is not very informative because of the occurrence of outliers, the statistics are presented for the center 80 percent of the items in each form. That is, the items were rank ordered in terms of p-values, and the values tabled for items at the 10th and 90th percentiles. For example, if a test had 40 items, p-values for the 4th and 36th most difficult items would be tabled. These ranges of p-values indicate that there was a good spread of item difficulties. Although not presented in this table, other analyses indicated that the constructed-response items tended to be among the more difficult items in each form.

The "Collapsed Levels" columns in Table 8 indicate items where there were too few examinees who scored in a particular level so that scaling of that level for that item could not take place. In general, if there were fewer than 4 students with scores in a level, calibration could not occur. When calibration cannot occur, adjacent levels are collapsed. There were few levels for few items in which collapsing was necessary. The sparse levels tended to be those for the highest score levels of the most difficult items. While collapsing of levels can be important in a final operational calibration, collapsing of levels has little impact in a tryout.

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[2] See Appendix B for Tryout Statistics.

The average percentage of maximum score (%MS) ranged from 33 to 47 for all 9 tryout forms. Thus, the test was fairly difficult for these students, but not so difficult as to create floor effects.

A final check after the initial item analysis was to identify items that were very difficult or had low item-test correlations. No mathematics items proved to be problematic under this consideration.

Reliability of Internal Consistency

The reliability of a test indicates how well the test items "hang together." For the High School Proficiency Test, reliability values are determined using internal consistency formulas, which indicate that the tests are measuring the same thing (within a particular test), and that students are answering consistently. Cronbach's alpha is used when there is a combination of multiple-choice and constructed-response items.

The coefficient alpha reliabilities were reasonable for the number of items in the mathematics tryout, ranging from .83 to .89. Coefficient alphas were computed in two ways, both including all items and excluding each individual item in each form of the HSPT in Mathematics tryout. The two outcomes were not statistically significantly different.

Content Validity

The current assessment is based on the *Michigan Essential Goals and Objectives for Mathematics Education*, which was approved by the State Board of Education in 1988. Because the current test is an achievement test used to endorse individual diplomas in mathematics, the most important type of validity to assess is content validity. To verify content validity, the test items must match the specified objectives given in the test blueprint or assessment framework.

Like all published achievement tests, the High School Proficiency Test in Mathematics has a blueprint which indicates the objectives to be tested. Not all objectives are tested in any given form of a test. Both easy and hard items are used in every form of the test to balance the difficulty level of the items and to equate the different versions of the test to one another. The sample of items chosen for a version of the test represents the domain of all possible test items that fit the blueprint. For a student to do well on the test, he or she must have mastered the entire domain, not just bits and pieces.

As stated earlier in this report, the EDT in Mathematics wrote all the tryout items based on the mathematics blueprint and framework documents. The CAC verified that each test question meets the objective it is supposed to measure, and fits the blueprint or framework. The BRC verified that the items are not disadvantaging any particular group.

Calibration Models

All calibration analyses were replicated using two sets of models, as recommended by the Technical Advisory Committee: (1) a combination of three-parameter logistic and two-parameter partial credit models (3PL/2PPC) and (2) a combination of Rasch logistic and Rasch partial credit models. The logistic models were used to analyze multiple-choice items and the partial-credit models were used to analyze constructed-response items. The purpose was to compare which set would more appropriately reflect data.

3PL/2PPC Model

The three-parameter logistic (3PL) model (Lord, 1980) allows items to vary in difficulty and discrimination and non-zero lower asymptotes ("guessing values"). It is commonly applied to multiple-choice items in tests like the HSPT, where guessing of correct answers can occur.

$$P_j(\theta) = P(X_j = 1 \mid \theta) = c_j + \frac{1 - c_j}{1 + \exp[-1.7a_j(\theta - b)]} \qquad (3)$$

where θ = examinee's latent trait
a_j = item discrimination parameter for item j
b_j = difficulty parameter for item j
c_j = guessing parameter for item j
X_j = observed score for item j
$P_j(\theta)$ = probability of answering item j correctly given person ability θ

For the jth constructed-response item with m_j levels, the item scores were integers ranging from 0 to m_j - 1. A two-parameter partial credit (2PPC) model allows items to vary in both difficulty and discrimination. It was used to calibrate constructed-response items (Yen, 1993). This model can be seen as a special case of Bock's (1972) nominal model and is the same as Muraki's (1992) "generalized partial credit model," which is used with the National Assessment of Educational Progress (NAEP) test. The probability of a student with ability θ having a score at the kth level of the jth item is

$$P_{jk}(\theta) = P(X_j = k - 1 \mid \theta) = \frac{\exp(z_{jk})}{\sum_{i=1}^{m_j} \exp(z_{ji})}, \qquad k = 1, \ldots, m_j \qquad (4)$$

where

$$z_{jk} = \alpha_j (k-1)\theta - \sum_{i=0}^{k-1} \sigma_{ji} \qquad i = 1, \ldots, k, \ldots, m_j \qquad (5)$$

and
$\sigma_{j0} \equiv 0$.

The α_j' is the item discrimination. σ_{ji} is related to the difficulty of the item levels: the trace lines for adjacent scores levels intersect at σ_{ji} / α_j.

The 2PPC model is as follows:

$$P_{j2}(\theta) = P(X_j = 1 \mid \theta) = \frac{1}{1 + \exp[-\alpha_j \theta + \sigma_{j1}]}. \qquad (6)$$

Then,

$$a_j = \alpha_j / 1.7, \qquad (7)$$

$$b_j = \sigma_{j1} / \alpha_j; \qquad (8)$$

Conversely,

$\alpha_j = 1.7a_j$ and $\sigma_{j1} = 1.7a_j b_j$

Rasch Model

The Rasch logistic model was used for multiple-choice items. .This model allows items to vary in terms of difficulty, but all items were assumed to have the same discrimination (1.0) and a zero asymptote:

$$P_j(\theta) = P(X_j = 1 \mid \theta) = \frac{1}{1 + \exp[b_j - \theta]}. \tag{9}$$

Because of these simplified assumptions, for a two-level item,
$a_j = \alpha_j = 1$,

$b_j = \sigma_{j1}$.
Masters' (1982) Partial Credit model was used for the constructed-response items. In formula,

$$P_{njx} = \frac{\exp \sum_{i=0}^{x} (\theta_n - b_{ji})}{\sum_{k=0}^{m} \exp \sum_{i=0}^{k} (\theta_n - b_{ji})}, \quad x = 0, 1, 2, \ldots, m_j \tag{10}$$

where P_{njx} is the probability of person n scoring x on constructed-response item j.

Calibration Analyses

Item parameters and θ estimation were conducted using both the CTB-owned program PARDUX (Burket, 1991; 1995) and commercial software BIGSTEP. PARDUX employs a marginal maximum likelihood procedure, implemented with an EM algorithm. Evaluations of the accuracy of the program with real and simulated data (Fitzpatrick, 1994) have found it to be at least as accurate as the Rasch program BIGSTEPS (Linacre & Wright, 1993). The MEAP office traditionally uses BIGSTEPS.

For the Rasch analysis of Mathematics Form 14 in Group 6, BIGSTEPS estimates were obtained in addition to the PARDUX analyses. The correlations between parameters obtained by the two programs were 1.00. In summary, the two programs produced very similar estimates, with the estimates being the most similar for the item score levels where the most data were available.

Fit Statistics and Analyses

Item fit was evaluated with PARDUX by a statistic comparing observed and predicted trace lines. This fit statistic is a generalization of the Q_1 statistic described by Yen (1981). Standardized fit values, referred to as Z statistics, can be compared over items and models. In addition, observed and predicted trace lines were compared graphically.

Rules of thumb were developed for flagging items for misfit. Recall that each item was scaled in two different samples. An item was flagged if it met either of the following criteria:

(1) Z's $\geq$ 4.0 in both samples or

(2) (one $Z \geq 4.0$) and ($4.0 >$ the other $Z \geq 3.0$), and a plot of expected and observed trace lines failed to demonstrate reasonable fit. (Note: Z scores are standard item fit scores with a mean of zero and a standard deviation of 1.)

These rules of thumb for flagging misfit items can be compared in terms of stringency to the criterion used by CTB/McGraw-Hill for the tryout of multiple-choice items for major achievement batteries, such as the California Achievement Tests, and the Comprehensive Tests of Basic Skills. For those tests, Zs of 4.6 are flagged, even though their sample sizes are usually at least twice the size of ones used in the present study. As sample size increases, the power of the fit statistic increases. Thus, the flagging criteria used in this study is less stringent than used by CTB/McGraw-Hill in some other testing programs.

Summaries of item fit results are presented in Tables 9, 10 and 11 (Appendix B). Far more items from the Rasch model had large Z values and were flagged for misfit than those from the 3PL/2PPC model. With the Rasch model, 40% (25/63) of the constructed-response items were flagged to be misfit, while with the 3PL/2PPC model, no constructed-response item showed misfit. However, for the 3PL/2PPC model, there were items whose parameters could not be estimated, called non-convergent items. These items were often difficult items with low discrimination values. For the Rasch model, on the other hand, parameter estimates were convergent for all items. Thus, neither model effectively described an item performance when its observed trace line was essentially flat and had weak relationship to the predicted trace line. It should be noted that all the results shown here are from the software program PARDUX. Verification of the results from the software BIGSTEPS, which was designed specifically for Rasch model analysis, showed that some items that were misfit with the PARDUX were proved to be fit with BIGSTEPS.

Item Discriminations

The item discriminations were systematically lower for the constructed-response items than for the multiple-choice items. On the average, the constructed-response items had discriminations that were 30% of the values for the multiple-choice items for mathematics. Discriminations reflect how sharply performance can be categorized into successive score levels. It is not surprising that this categorization is less distinct with items that involved human evaluations of multiple levels of complex student performance.

The fact that the constructed-response items had lower discriminations does not mean that these items are "less important" or contribute less information to the overall test score. The formula for item information is the following:

$$I(X_j \mid \theta) = a_j^2 \sigma^2(X_j \mid \theta) \qquad (11)$$

The item information is a function of both the item discrimination (α_j^2) and the variance (σ^2) of the item scores. Items with more score levels tend to have substantially greater score variances, thus adding to the information they provide. Despite their lower discriminations, the constructed-response items provided substantial amounts of information. Under the Rasch model, where all items are assumed to have the same discrimination, items with more score levels must be described as providing more information.

Table 12 (Appendix B) presents means and standard deviations of discrimination parameter estimates for all forms. Table 13 (Appendix B) compares the information indices obtained by the 3PL/2PPC model and the Rasch model.

Equating

The equating process was conducted for both the Rasch and the 3PL/2PPC models. The within-triplet theta (or scale score) distributions were aligned. The Stocking and Lord (1983) procedure was applied to the forms in common to the triplets (Forms 13, 15, 17 and 16), as indicated by the solid lines in the following.

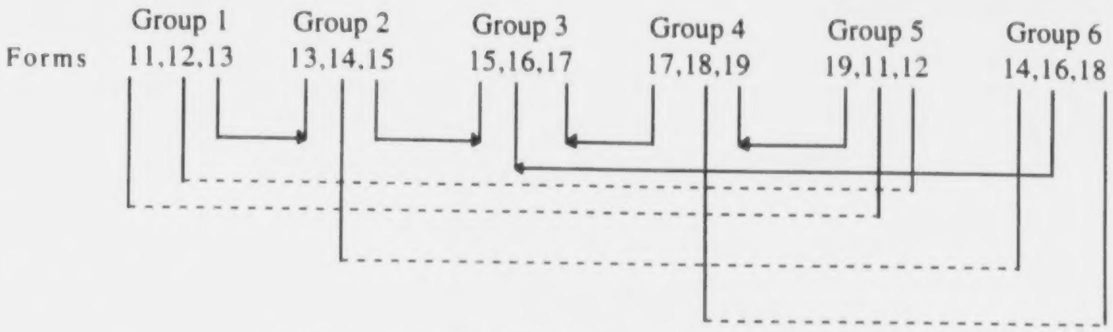

Figure 3. Configuration of Form Triplets for Equating

The dotted lines indicate forms that were not included in the Stocking and Lord links (Forms 11, 12, 14, 18). These forms, therefore, could be used as a check on the adequacy of the equating. Forms 11 and 12 were of particular importance because the parameters from groups 1 and 5 were the "furthest apart" in terms of the linkings; that is, four Stocking and Lord links and five equivalent group links tied them together. By comparing the Form 11 test characteristic function based on the parameters from Group 1 to that based on Group 5, the adequacy of the link network could be double-checked. Similar checks could be done for forms 12, 14 and 18. The checks showed that both models produced good equating results.

Scaling Model Recommendations by Contractor[3]

The advantages of using a Rasch model are its simplicity and elegance. Also, if data are scarce, Rasch model predictions tend to be more stable than those from a model with more parameters. The disadvantage of the Rasch model is that its simplifying assumptions may be inappropriate for a particular data set, as reflected in the model misfit. If the model does not fit the data, then either misfit items need to be deleted from the test, or the inaccuracies of the model need to be lived with. The most serious types of inaccuracies that can occur result in equating or scoring errors.

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[3] The Technical Advisory Committee recommended the use of the Rasch Model over the 3PL/2PPC model for a large-scale assessment such as the HSPT

Racial and Gender Bias Analyses

Mantel Statistic for Ordered Response Categories

A Mantel-Haenszel methodology was used in the evaluation of the tryout items for differential item functioning (DIF). A statistic proposed by Mantel (1963) was obtained for specified racial and gender groups:

$$\chi^2 = \left[\sum F_k - \sum E(F_k)\right]^2 / \sum Var(F_k), \qquad (12)$$

where F_k, the sum of scores for the focal group at the *k*th level of the matching variable is:

$$F_k = \sum y_i n_{Fik}\,. \qquad (13)$$

Readers are referred to Zwick et al. (1993) for a description of the terms of the statistic. The Mantel statistic, while necessary for the assessment of DIF in the constructed-response items in each of the three content areas, reduces to the Mantel-Haenszel chi-square statistic (without continuity correction) when applied to the multiple-choice items. The Mantel statistic explicitly takes into account the possible ordering of the categories of the polytomous items, as opposed to a procedure proposed by Mantel and Haenszel (1959) that provides for a comparison of the reference and focal groups with respect to their entire response distributions. The Mantel statistic has a chi-square distribution with one degree of freedom.

Because the number of students in the minority groups taking each form was relatively small (almost always less than 200 per form), and the number of levels for some of the constructed-response items was large (greater than five) when item scores were obtained by summing judges' ratings, the number of levels for the constructed-response items was collapsed (see Table 8 in Appendix B for details). After collapsing adjacent levels, the number of remaining levels that were evaluated for each constructed-response item was half the maximum number of points plus one, or the same number of levels specified by the scoring rubrics for each item for each individual reader.

As specified by MDE for a sample of schools that were supplied to CTB/McGraw-Hill, item responses were analyzed for gender bias by evaluating DIF against females (focal group), with males as the reference group. The number of females in these analyses was large, approximately half of the roughly 1000 students who took each form.

The particular racial groups that were evaluated in the racial bias analyses were determined by the numbers of students in these groups that took the 29 tryout forms in the three content areas. The only group, excluding whites, that had appreciable numbers taking each form was African-Americans. Seventeen of the forms were administered to more than 100 African-Americans. The 12 forms that had fewer than 100 African-Americans were due to two schools with large African-American enrollments dropping out of the sample and the failure to receive scores from a third school. A fourth school did not have as large an African-American population as expected.

After African-Americans, no defined racial group had consistently as many as 30 students taking each form. Consequently, Mantel statistics were obtained for a single (focal) racial group, African-Americans, treating whites as the reference group in the racial bias analysis.

Mantel racial and gender statistics were obtained for each form of the mathematics test by stratifying on total score. A total of 46 out of 423 mathematics items had a Mantel statistic that indicated racial DIF at a .05 significance level compared to 110 items that were flagged at the same significance level for gender DIF. The computation of standardized mean difference was employed to provide further estimation on item bias.

Standardized Mean Difference

Although the number of items that had significant Mantel gender statistics in each of the three content areas is substantially larger than the number of items having significant racial statistics, there are three reasons why the number of significant statistics cannot be considered to reflect the magnitude of DIF within each content area. First, the Mantel statistic is *asymptotically* distributed as chi-square, requiring a minimum expected number of five students within each of the cells defined by the combinations of strata and item levels. For the racial analysis, this assumption is frequently violated.

Second, a significant Mantel statistic rejects the null hypothesis of no DIF against the alternative hypothesis of DIF either against the focal *or* the reference group. Hence the number of significant Mantel statistics does not reflect solely DIF against the assessed focal group.

Finally, the much larger sample sizes for the female focal group relative to the African-American focal group results in more statistically powerful tests (i.e., tests that are more capable of correctly rejecting the null hypothesis of no DIF) in the gender analysis. The Mantel statistics for gender can detect the presence of smaller, and perhaps practically insignificant, amounts of DIF than the corresponding statistics from the racial analysis. An analysis of DIF that is more suitable to demarcating practically significant amounts of DIF across both racial and gender analyses would utilize an effect size index.

Unfortunately, while an effect size index in the form of the Mantel-Haenszel common odds ratio estimate, alpha, is available for the dichotomously scored items, no *single* analogous odds ratio-estimate is available for the polytomous items. However, the standardized mean difference (SMD) noted by Zwick et al, (1993) offers an acceptable alternative,

$$\mathrm{SMD} = \Sigma p_{Fk} m_{Fk} - \Sigma p_{FK} m_{RK}, \tag{14}$$

where $p_{Fk} = n_{F+K}/n_{F++}$ is the proportion of focal group members who are at the *k*th level of the matching variable, $m_{FK} = (1/n_{F+K})\ (\Sigma y_t n_{RtK})$ is the mean item score for the focal group at the *k*th level, and $m_{RK} = (1/n_{R+K})\ (\Sigma y_t n_{RtK})$ is the analogous value for the reference group. As an effect size index, the SMD statistic takes into account the natural ordering of the response levels of the items and has the desirable property of being based only on those ability levels where members of the focal group are present. A positive value for a SMD reflects DIF in favor of the focal group.

Distributions of Standardized Mean Differences

Both racial and gender SMDs were obtained for the items in every form and are presented with the Mantel statistics. Ranges of the racial and gender SMDs for mathematics are:

Table 14. Ranges of Racial and Gender SMDs in the Mathematics Tryout

Content Area	Racial	Gender
Mathematics	- .40 to .54	- .26 to .34

An evaluation of both the Mantel and the SMD statistics for the racial comparisons suggested that levels of standardized mean differences that have practical significance could be determined. Statistically significant (p = .05) racial Mantel statistics were often associated with SMDs that had absolute values of .10 and greater. Setting a criterion of -.10 for a determination of practically significant DIF, representing a one tenth of a score point decrement in focal group performance relative to the reference group (controlling for ability), would allow a goal of limiting the conditional between-focal-and-reference-group difference to no more than one score point in any form. The distribution of SMDs for Mathematics below appears to permit the construction of forms having 10 or fewer items demonstrating DIF either against a racial or against a gender group that an individual form could have and still attain the maximum one score point conditional group difference goal. A maximum of one score point difference is desirable, given the high-stakes nature of the test.

Table 15. Michigan HSPT in Mathematics
Frequency Distribution of Items by Racial SMDs

(SMD≤-.30)	(SMD≤-.20)	(-.19≤SMD≤-.10)	(-.09≤SMD≤.09)	(.10≤SMD≤.19)	(SMD≥.20)	(SMD≥.30)
2 items	3 items	30 items	347 items	35 items	8 items	4 items

Table 16. Michigan HSPT in Mathematics
Frequency Distribution of Items by Gender SMDs

(SMD≤-.30)	(SMD≤-.20)	(-.19≤SMD≤-.10)	(-.09≤SMD≤.09)	(.10≤SMD≤.19)	(SMD≥.20)	(SMD≥.30)
0 items	1 items	20 items	388 items	10 items	4 items	2 items

Overall DIF Rating

The distribution of racial and gender SMDs under the criterion of -.10 for practically significant DIF allows the construction of an overall rating of DIF that combines both racial and gender DIF against the focal groups. An overall rating is a useful index in the development of the pilot or operational forms. Content editors can utilize test development software to select items in a manner that minimizes DIF against both focal groups.

A useful overall index of DIF might allow several gradations of the practical severity of both racial and gender DIF. An item could be considered to manifest a lower degree of practically significant DIF against a racial or gender group if the SMD ranged between -.10 and -.19 and a more serious degree of DIF if the SMD was less than or equal to -.20. An item would accumulate one point on the overall rating scale if the racial SMD fell in the former category and two points if the racial SMD fell in the latter category. Similarly, an item would accumulate an additional point on the overall scale if the gender SMD fell in the former category and two points if in the latter. Consequently, if an item demonstrates neither of the two levels of practically significant racial DIF and neither of the two levels of practically significant gender DIF, the item's overall rating would be one (zero would seem to be a less desirable alternative because it connotes the absence of DIF). An item would obtain the maximum overall rating of five if both racial and gender DIF was of the more serious kind. An overall rating of two would imply the item had a racial or gender SMD between -.10 and -.19, but not both. An overall two, three, or four could be obtained by various combinations of lower and higher levels of practically significant racial and gender DIF. All possible overall ratings are described in the table below.

Table 17. Overall DIF Rating Classification as a Function of Gender and Race

Gender DIF	Race DIF		
	(.09 ≥ SMD ≥ -.09)	(-.10 ≥ SMD ≥ -.19)	(-.20 ≥ SMD)
(.09 ≥ SMD ≥ -.09)	1	2	3
(-.10 ≥ SMD ≥ -.19)	2	3	4
(-.20 ≥ SMD)	3	4	5

Table 18. Frequency Distribution of Mathematics Items by Overall DIF Rating

DIF Rating	1	2	3	4	5
# of items	376	38	8	1	0

Detailed DIF statistics are presented in Table 19 (Appendix B).

Items with a DIF rating of two or higher were subject to an additional review by the Bias Review Committee and the Content Advisory Committee for any apparent bias. If none was found and the item was determined to adequately measure the test content, it was kept.

Pilot Test

Items that survive the tryout stage are then piloted before they are used in an operational test. Frequently, 25-50% of items tried out are discarded at the tryout stage. Based on review of the HSPT in Mathematics tryout results, CTB worked with the CAC and MDE staff to refine items and scoring rubrics before piloting began. Sufficient numbers of items survived the tryout to construct eight pilot forms of the test. A major change was that one constructed-response item was eliminated from all forms, leaving six in total that remained for the operational tests.

The purposes of the HSPT in Mathematics pilot administration were to:

- check if revisions based on the tryouts were successful, or whether an item should never be used;
- produce 6 equivalent forms of the High School Proficiency Test in mathematics that could be used interchangeably in future administrations;
- examine characteristics of the revised items in each form; and,
- examine technical soundness of the reconstituted forms for operational administrations.

CTB made all necessary revisions of the assessment materials suggested by the CAC and MDE. They also prepared the test booklets, answer documents, administration manuals and all supporting materials for the pilot administration.

Pilot Sampling

As in the tryout, the target population for the pilot was all eleventh graders in Michigan, including students in both public and private schools. The sampling procedure was the same. Fewer schools were sampled in the pilot because fewer forms were tested. However, the proportions of participating students by gender and ethnicity were very similar to that of the tryout. When a sampled school declined to participate in the pilot, a substitute school with similar characteristics was replaced. The number of students taking each form is listed in Table 20 below.

Table 20. Number of Students Participating in the HSPT in Mathematics Pilot by Form

Form	# of Students
4	1122
5	1255
6	1217
7	1213
8	1383
9	1404
10	1261
11	1105
Total	**9960**

Pilot Administration

Sampled schools were asked to test all eleventh grade students during a five-day administration window in April 1995. Classroom teachers were asked to administer the test. For security purposes and to minimize the exposure of test forms, makeup testing for students who were absent during the pilot was not recommended.

General Results

A summary of the descriptive statistics by form and by individual items is presented in Tables 21 and 22 (Appendix C).

Table 21 provides descriptive statistics for both the complete sample that took a form and the two constituent subsamples taking the same form as it was administered within spiraled sets of two forms. Complete sample form means for the eight mathematics forms in Table 21 ranged between 30.14 (Form 5) and 32.69 (Form 9) out of 61 possible points. There was no mean p-value greater than .55 on any of the test forms, but some individual items had p-values that were quite high. This indicates that these items were moderately difficult for the 11th grade student sample. Considering each form as a whole, the mean item-test correlations were in the .40's and the coefficient alphas were around .90 for all forms. Both of these statistics were very high, implying that the forms were very consistent internally.

Also presented are the raw means for each item at 5 quintiles and point biserial correlation coefficients for each option of individual multiple-choice items. In general, the distributions of p-values spread relatively evenly within a form, with more items on the lower end than on the higher end. While this implies that the items were fairly distributed for this pilot sample, very few items had p-values below .20. The p-values for the constructed-response items were, on average, lower than those of the multiple-choice items. This finding is not surprising in that it was the first time that constructed-response items were used on MEAP tests.

Interrater Agreement

On the pilot, scores for constructed-response items were obtained by averaging the ratings of two or three judges and rounding to the nearest integer. Only when the two readers' scores were not the same or adjacent - that is, more than one point apart on the same item - was the third reader introduced. Table 23 contains ranges for judges' agreement, defined as scoring within one point with the second judge, and consistency, scoring within one point with the second or third judge, when the first two judges disagree by more than one point. Excluding those indices computed for a judge who read very few papers (indicated in [ ] in Table 23), consistency indices ranged between 91% and 100%.

Table 23. Michigan HSPT in Mathematics Pilot
Interrater Reliability Indices

FORM NUMBER	RANGES	
	AGREEMENT RANGE (%)	CONSISTENCY RANGE (%)
4	95-100	97-100
5	89-100	92-100
6	91-100	93-100
7	97-100	98-100
8	90-100	91-100
9	94-100 [83(6)]*	96-100 [83(6)]
10	93-100	94-100
11	97-100	97-100

Agreement - percentage of time that a reader agreed, within one point, with a second reader.

Consistency - percentage of time that a reader agreed, within one point, with the second or third reader.

* One reader completed only six readings for Form 9 with an agreement rate of 83%. The next lowest agreement rate for this form was 94%.

Interrater agreement statistics are presented in Tables 24-25 of Appendix C.

Scorers were hired and trained by CTB to score the constructed-response items for the pilot test, using Michigan standards. As in the tryout, reader reliability was calculated by the agreement ratio of the first two readers. The six constructed-response items in each form were worth from two to five points each. The mean agreement was at least 73.4% for most items, with 4-point and 5-point items having lower agreement ratios (see Table 24). There was no average non-adjacent reader agreement greater than 6%.

The frequency distributions of raw scores for the constructed-response items varied greatly within a form (Table 26, Appendix C). For instance, on item 4 of Form 4, 644 students received 0 points and only 87 students got the maximum number (2) of points possible.

It should be noted there were from 91 to 591 students choosing to leave a constructed-response item blank. In most cases, there were between 200 and 400 students, up to 43.3% of the tested students, leaving the item blank.

Group Descriptive Analysis

Descriptive statistics for four groups: whites, African-Americans, females, and males are presented in Table 27 for each of the eight mathematics forms. Males and females have approximately similar performance on the mathematics forms, while White means are higher than African-American means on all forms of the mathematics test. The difference in group means was generally larger for the mathematics and science forms than for the reading forms.

African-American form means in Table 27 are based on less than 100 students for mathematics Form 10. The relatively small number of African-Americans may be attributed to the difficulty of getting a large number of high schools in metropolitan and other urban areas with large African-American enrollments to participate in the pilot.

Gender/Ethnicity DIF Statistics

Table 28 contains DIF (differential item functioning) statistics, in the form of standardized mean differences (SMDs) for two group comparisons: males versus females and whites versus African-Americans. The SMDs for each comparison were partitioned into four groups in accordance with the procedure used for the tryout forms. Items that demonstrate large "practically significant" DIF against males or whites have SMDs greater than or equal to .20. Items that demonstrate large "practically significant" DIF against females or African-Americans have SMDs smaller than or equal to -.20. A SMD between .10 and .19 (inclusive) or between -.10 and -.19 (inclusive) denotes items that have "practically significant" DIF against males and whites or against females and African-American students, respectively.

Given the magnitude of the SMDs for the items demonstrating large "practically significant" ($|\mathrm{SMD}| \geq .20$) versus "practically significant" ($.10 \leq |\mathrm{SMD}| \leq .19$) DIF, any item with a SMD in the former category can be considered to manifest twice the amount of ("practically significant") DIF against one of the four assessed groups than items with SMDs in the latter category. Hence a determination of the total amount of "practically significant" DIF that a form demonstrates against any one of these four groups can be obtained by multiplying the number of items manifesting large "practically significant" DIF by two and adding the number of items that demonstrate "practically significant" DIF. Note that several white versus African-American comparisons are based on relatively few (less than 100) African-Americans.

The eight mathematics pilot forms were constructed, using the tryout DIF statistics, to ensure that the absolute difference in the amount of DIF (hereafter synonymous with "practically significant" DIF) of whites versus African-Americans **and** the absolute difference in the amount of DIF of males versus females was no greater than three. The purpose of constraining the absolute difference in DIF to no more than three for each of the two group comparisons was to ensure that DIF was relatively balanced across each of the two groups in each of the two comparisons.

The absolute difference in the amount of total DIF for the 16 comparisons (2 comparisons times 8 forms) can be seen in Table 28, within each pair of evaluated groups. The differences were frequently very small. For only three of the 16 comparisons are the absolute difference in DIF exceed three. These three comparisons include an absolute DIF of five against African-Americans for Form 11, an absolute difference of six against males for Form 9 and an absolute DIF of four against males for Form 10. The existence of three comparisons that attained an absolute DIF difference greater than three in the pilot and not the tryout may most likely be attributed to the sampling variability of the tryout and pilot DIF statistics.

Summary

In summary, even though they were difficult, all the pilot forms showed high test reliability. Students had more difficulty answering constructed-response items than multiple-choice items. In fact, a fairly large proportion of students did not respond to the constructed-response items. The interrater agreement between the two scores for the 2- and 3-point constructed-response items was higher than that for the 4- and 5-point items.

Part 4. Student Survey and Teacher Survey

The Technical Advisory Committee (TAC) recommended that a study be done prior to the first administration of the Michigan High School Proficiency Test and again just prior to the time when the first graduating class would be impacted.

In early 1994, planning for an opportunity to learn study began. It was tentatively agreed that the final responsibility for the design must reside at the State Department level, that members of the Framework Committees should be involved in the design, that teachers in every district needed to be surveyed, that students should be sampled, and that the TAC should review the sampling plan and the draft survey instrument(s).

In March 1994, one TAC member, Department staff, and a member of the Science Framework Committee reached two major decisions:

(1) Surveys would be sent to every high school to the subject matter coordinators for the content areas tested on the HSPT. They would be asked to form committees of teachers from their high schools as well as their feeder schools to fill out the survey.
(2) A sample set of students would be part of the study.

In subsequent meetings with the Mathematics Framework Committee, discussions were held regarding the content and the format of the surveys. It was agreed that the general form of the surveys was to be the same across content areas, but that form should not take precedence over substance and if there were good reasons for having different formats, it would be allowed. Content area experts were to be responsible for the actual wording of the surveys.

The study was originally intended to address three purposes: (1) to help make adjustments to the tests if necessary, (2) to aid in standard setting and (3) to provide schools with information that could be used for professional development.

On September 2, 1994, an overview of the proposed design was presented to the TAC. The TAC members suggested that the names of the surveys be changed from "opportunity to learn" surveys to the "Teacher Survey" and the "Student Survey." Revisions were suggested and made for the Student Survey. The Teacher Survey was discussed at length, reviewed and revised. Both the student and teacher surveys were piloted at several sites before being sent out.

Mathematics Student Survey Results

The Mathematics Student Survey (see Appendix D) was given to the students who participated in the mathematics tryout. The students completed the survey prior to taking the item tryout "tests" so that student perceptions pertaining to performance would not influence survey responses.

The mathematics survey contained 27 statements. The common stem was as follows: "By the end of tenth grade, how often did your school experience include:..." Students were to respond on a four-point scale from "never" to "a lot." Note that "never" was translated to a value of "zero" (0), "very little" to "1", "some" to "2", and "a lot" to "3."

Table 29 below presents the summary data for the student survey results. The mean score for the 27 mathematics survey questions was 1.95 (2.00 = some). The lowest mean for a survey question was 1.31, which places it about one-third of the distance between "very little" and "some." Only three questions (11%) had a majority of the students respond less than "some." Only three questions (11%) had a mean less than 1.5. By strand, the mean survey scores ranged from a low of 1.77 for geometry to a high of 2.31 for number.

Because the surveys were given to the same students who participated in the tryout, it was possible to correlate the mean scores for the students on the survey with their scores on the tryout tests. The correlations are positive, but not particularly high (.3731). Thus, the students' perceptions of whether they were taught something did not seem very highly related to how they actually scored on the tryouts.

Among the content areas, it appears that the student survey results were most positive in mathematics. Mathematics had the highest survey mean, the highest "lowest" item mean, and the smallest percent of questions being marked less than "some" or having means less than 1.5. Mathematics also had the highest correlation between the survey scores and scores on the tryout tests, although the coefficient of determination (the correlation of .37 squared) suggests that only about 14% of the variance in student test scores can be predicted from the variance in their responses to the survey questions.

Table 29: Student Survey Results Summary
Content: Mathematics

Total # of questions	27
overall mean	1.95
lowest mean	1.31
# & % of questions that the majority marked less than "some" (2.0)	3 (11%)
# & % of questions with a mean less than 1.5	3 (11%)
correlation statistic of survey mean and tryout score	.37

Conclusions From Student Survey

In drawing conclusions from the student survey results, one must keep in mind that there was no good way of determining how honestly students responded to the questions or even the extent to which they understood the questions. Given those cautions, it was concluded that school experiences in general included the types of activities useful in assisting students to learn the content to be tested on the proficiency test. The fact that the lowest mean for any mathematics survey question was 1.31 suggests that all of the activities were (in general) being experienced at more than "very little" frequency.

Mathematics Teacher Survey

The Teacher Survey was sent to mathematics supervisors at all high schools in the state (N=758), May of 1995. These supervisors were each to form a team of teachers to work with them in completing the Teacher Survey and an Instructional/Curriculum Support Materials Form, which they did not need to return.

The mathematics teacher survey is composed of 56 statements organized by strands and objectives within strands. The strands are as follows: (a) number, (b) data analysis, probability, and statistics, (c) algebraic ideas, and (d) geometry/measurement. For each statement, the respondents completed two columns. In the first column, they circled all grades receiving instruction, and in the second column they circled the one grade at which sufficient classroom instruction had occurred to expect understanding/proficiency.

Summary Of Teacher Survey Results

In summarizing the mathematics teacher survey results, it must be remembered that the data analyzed is based on a low return rate of 251 responses out of 758 surveys sent to schools. So, the responses may not be representative. Nevertheless, some tentative findings emerge from the teacher survey results which are summarized in Table 30:

- for eight of the 56 statements, no school circled "NT" (Not Taught);
- for one statement, no school circled "NSI" (Not Sufficient Instruction);
- only one of the 56 statements had more than 50% of the schools circle the "NT" response;
- only four statements had more than 25% of the schools circle "NT";
- nine statements had 50% or more of the schools circle "NSI";
- thirty-nine of the 56 statements had fewer than 10% of the schools circle "NT";
- twenty-one statements had fewer than 25% of the schools circle "NSI"; and
- twenty-one had "NSI" circled by fewer than 10% of the schools.

Contrary to the student survey results, there was a higher percent of mathematics statements where both more than 50% and more than 25% of the schools circled "NSI" than for the other subjects. However, for 38% of the statements, "NSI" was circled by less than 10% of the schools.

Table 30. Teacher Survey Results Summary
Content: Mathematics

# and % of statements where NT circled by 25% or more	5 (9%)
# and % of statements where NSI circled by 50% or more	9 (16%)
# and % of statements where NSI circled by 25% or more	25 (45%)
# and % of statements where NSI circled by less than 10%	21 (38%)

Overall Summary And Follow-Up[4]

Both the student and teacher survey results suggested that many of the objectives were already being taught in the majority of the schools and that they were sufficiently taught for students to have proficiency in them. However, in mathematics, there were a number of objectives that were not judged to have been taught with sufficient thoroughness.

The results of both the teacher and student surveys were presented to the standard setting committees at the time they made recommendations regarding scores. Prior to that time, the department devoted considerable time determining just how the data should be presented and what the committees should be told about the relevance of the data for standard setting. It must be stressed that these data were gathered in the 1994-95 school year, and that information about the content of the proficiency tests continued to be widely disseminated before the test was given in the spring of 1996. It is reasonable to believe that instruction in the schools has become more aligned to the objectives tested as time has passed.

The results of these surveys were disseminated to curriculum coordinators in the schools who were encouraged to use them in planning curricular/instructional changes prior to the first administration of the HSPT. It should have been clearly understood by local schools that it is in the best interests of their students to teach them material from a content domain that is sampled on a test whose passing is,a requirement for a state-endorsed certificate.

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[4] In July, 1996, the State Board of Education approved the standards as set by the standard setting committees, without changes. Information about the student and teacher surveys is adapted from a paper presented at 1996 Michigan School Testing Conference by Mehrens, Smolen and Yan.

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Appendix A

Expert Panel*

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Expert Panel Recommendations

1. The State Board should not specify subject areas other than Communications Skills, Mathematics, and Science for the initial assessment.

2. Communication skills assessed during the first assessment cycle should be limited to reading and writing.

3. The State Board and the Michigan Department of Education need to determine which subsets of the model core curriculum should be included in the assessments. This needs to be done very shortly. The decision should be based on recognition of the importance of students' opportunity to learn the content and some knowledge regarding what is likely to be in the school curricula by the date of the first test. The decision should not be that the total core curriculum is the appropriate domain from which to build the tests.

4. Once a determination is made regarding the testable portion of the core curriculum, there should be an administrative rule or statute that specifies this portion of the core is exempted from the permissive language in P.A. 25 and must be taught by the local districts to all students.

5. Once the testable portion of the core is determined, there should be wide publicity of this to the local districts. Consideration should be given to how this information can be disseminated with enough detail to let students and educators know the knowledge and skills to be tested but without so much detail that the students can answer the questions without understanding the curricular elements from which the items are only a sample.

6. Gather evidence from both teachers and students regarding the opportunity to learn the content domain the tests sample prior to the first administration.

7. Provide instructional support and training to local teachers if there is a need.

8. The State Board should not make any changes in the core curriculum or selected testable core prior to 1997.

9. When (or if) any changes are made in the core curriculum, there must be a phase-in period, and the tasks described in recommendations 3 through 7 would need to be repeated.

10. Name the assessment the "Michigan High School Graduation Tests.[5]

11. The Department of Education should caution its employees and the State Board against making any unsubstantiated statements about what the tests measure or what inferences can be made from the test scores. There should be an official statement about the tests and the inferences that can be drawn from the scores.

12. Demand that the test developer design sufficient safeguards to ensure that the test adequately samples the defined content.

13. Be careful not to make any official statements that would suggest the test has criterion-related validity if supportive data have not been gathered.

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[5] Because there will be different tests for different content areas, we suggest the plural "tests". However, for ease in subsequent writing we will, at times, refer to the total assessment as a test. When we do so, it should be understood that the reference includes all the tests.

14. Contract for enough items initially so that after losses through pilot and field testing there will be enough to build forms through the 95-96 administration year.

15. Reissue a contract in sufficient time to have items developed and tried out (possibly embedded in a live form) prior to their being needed for the 96-97 year.

16. Schedule a large scale field tryout for tenth graders by the spring of 1994.

17. Appoint and train a standard-setting committee.

18. Use a technical advisory committee to help develop a specific standard-setting procedure.

19. The State Board of Education should establish a passing score through administrative rule based upon a recommendation by the superintendent of public instruction with the advice of appropriate committees.

20. Consider setting incremental cut scores for different graduating classes at the time the State Board of Education makes its initial decision.

21. The item sensitivity reviews should be completed by a committee that is selected and trained specifically for this task. Most members should represent Michigan's predominant minority groups. However, it would be wise to have at least one member of the committee be a minority group member from out-of-state who is a recognized expert in the area.

22. Statistical item bias studies should be conducted. Items which show up as statistically biased should be reviewed (but not necessarily discharged) by an item bias committee (conceivably, but not necessarily the committee used for the item sensitivity review) and a content review committee.

23. Obtain the following reliability estimates: internal consistency, inter-rater reliability, generalizability across writing samples, and the reliability or standard error at the cut score.

24. Scores should be reported as "Pass" or "Fail". Those individuals who fail should be given some information regarding how close they were to passing, and they should be given some diagnostic information that would facilitate remediation efforts. There are important technical details (e.g., reliability of difference scores) regarding various methods of reporting diagnostic information and specific plans should be formulated by a technical advisory committee prior to approval of the final test specifications.

25. We would encourage use of a common scale across subject matter areas. This takes some advance planning to avoid adopting a scale that is appropriate for one test, but unworkable for another.

26. Develop detailed rules (procedures) for designating forms for make-up examinations and out of school (i.e., Adult Ed.) populations. Determine whether you should ever reuse a form. Determine how many times you will administer the test each year. Determine equating procedures (e.g., number of anchor items to be used). Based on these considerations, initially develop enough alternate forms to last through at least the 1995-96 school year. Start developing more forms/items prior to that so a sufficient supply is continuously available.

27. Use a technical advisory committee to help develop specific equating procedures.

28. Consider carefully policies regarding all test administration conditions. For example, the decision of whether or not to use calculators in the mathematics test must be made by the department, not by local school personnel. Train local school personnel adequately to administer the tests. Consider random auditing of the administration process to ensure uniformity throughout the state.

29. Be cautious about any "predictive" interpretation of the scores of any single individual from testing in earlier grades. Such tests should be thought of as providing only an early awareness.

30. The department should prepare and have the board adopt written procedures regarding make-up examination provisions.

31. The department should prepare and have the board adopt specific written rules regarding the number of retakes that should be allowed, and how many attempts a student should be given prior to the time he/she is scheduled to graduate.

32. Develop a detailed proposal that addresses questions regarding remediation efforts and the respective responsibilities of the state, the district and the student for remediation efforts.

33. Enact an administrative rule regarding testing issues related to special education students and students with limited English proficiency.

34. Individuals in adult education programs who wish to receive high school diplomas after the end of the 1996-97 school year should be required to pass the High School Graduation Test.

35. Obtain the services of the Attorney General's Office early on in the process and continuously as new policies are developed and implemented.

36. The State Superintendent of Public Instruction and the State Board of Education should work with the legislature to adopt statutory authority for the high school graduation testing program.

37. Carefully investigate liability issues with assistance from the Attorney General's Office. Attempt to obtain necessary statutes with respect to liability. Inform all committees and all staff regarding their potential liability.

38. Schools should be notified immediately regarding this graduation requirement and the information disseminated to all teachers. Students and their parents should be notified no later then the spring of 1993.

39. The department should prepare, and the board should adopt, detailed policies regarding what should be documented and how long the documentation should be kept on file. We generally suggest that all documentation be kept for a period of at least five years following the school year in which the test was administered. We suggest keeping "forever" the initial development documentation and records about when, why, and how procedures are adopted and/or changed.

40. In consultation with the Attorney General's Office, and based in part upon discussions with representatives of state education associations (e.g., teachers' unions and administrators' associations), the department should prepare, and the State Board of Education should adopt, rules regarding what constitutes inappropriate behavior on the part of educators or students with respect to test-taking behavior, security issues, and so forth; and what

penalties will be imposed for violation of these rules. These rules and the penalties should be disseminated to educators and students prior to the initial administration of the graduation test.

41. The department needs to develop a complete list of rules/regulations that need to be adopted and decide whether these can simply be adopted by the board or whether they need legislative approval.

42. Detailed security arrangements need to be developed.

43. Detailed policies regarding security valuations need to be established. Staff should investigate current laws regarding freedom of information exclusions, and if they are insufficient, request new legislation to exempt secure test materials from the freedom of information regulations.

44. The department needs to determine what additional equipment/facilities are needed for storage of secure materials, shredding out-of-date secure materials, etc.

45. An annual test administration plan should be developed and disseminated to all school districts.

46. The tests should first be administered to 10th graders in the spring of 1995 and they should be administered at least twice each in the junior and senior years.

47. The department should conduct a careful study to assess additional staffing needs in assessment and instructional programs.

48. The position of supervisor of state assessment should be filled as quickly as possible.

49. The following advisory committees should be appointed: 1) a Michigan Department of Education Steering Committee, 2) a Testing Policy Advisory Committee, 3) a Bias Review Panel, 4) a Technical Advisory Committee, 5) a Content Review Committee in each content area of the test, 6) an overall content review committee, and 7) a Standard Setting Committee.

50. Use at most two contractors: one for test development and formal field tryouts; and another for test administration, scoring, and reporting.

51. Obtain more detailed information from other states with similar programs regarding fiscal needs. Make recommendations to the legislature that are sufficient to cover department needs, and make clear to them that the task simply cannot be done without adequate support.

BIAS REVIEW COMMITTEE COMMENT SHEET

MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM
MICHIGAN DEPARTMENT OF EDUCATION

TEST ITEMS BEING REVIEWED (Content Area and Grade) ____________________

DATE________________________ MDE Representative__________________

The below items were judged to be problematical by the Bias Review Committee.

Form #	Item #	Bias Issue	Comments

BIAS REVIEW COMMITTEE

MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM
MICHIGAN DEPARTMENT OF EDUCATION

TEST ITEMS BEING REVIEWED (Content Area and Grade) ____________________

DATE ____________________ MDE Representative ____________________

The below items were reviewed by the Bias Review Committee who were asked to review items with sensitivity to gender, racial or ethnic groups, religious groups, socioeconomic groups, people with disabilities, and regional concerns in mind. Checked items were not judged to be biased in the above categories. Items with an asterisk (*) were judged to be biased and therefore have further comment and explanation on the attached Bias Review Comment sheet.

Form #	Item #	Stereotyping	Underlying Assumptions	Controversial Material	Contextual Concerns	Elitism or Ethnocentrism	Other

Michigan School Stratum Classification

The Michigan schools are classified into seven strata relative to populations where the schools reside.

1. Large City
   Central city of a Metropolitan Statistical Area (MSA) with a population greater than or equal to 400,000 or a population density greater than or equal to 6,000 people per square mile.

2. Mid-size City
   Central City of an MSA with a population less than 400,000 and a population density less than 6,000 people per square mile.

3. Urban Fringe of Large City
   Place within an MSA of a Large Central City and defined as urban by the Census Bureau.

4. Urban Fringe of Mid-size City
   Place within an MSA of a Mid-size Central City and defined as urban by the Census Bureau.

5. Large Town
   Town not within an MSA and with a population greater than or equal to 25,000 people.

6. Small Town
   Town not within an MSA and with a population less than 25,000 and greater than or equal to 2,500 people.

7. Rural
   A place with fewer than 2,500 people and coded rural by the Census Bureau.

Criteria for Writing and Editing Multiple-Choice Items

☐ The item is free of gender, ethnic, racial or other bias.

☐ The content of the item is grade-appropriate.

☐ The reading level of the item stem and answer choices is suitable for the student being tested.

☐ All factual information has been checked and documented against reliable, up-to-date sources.

☐ A student possessing the skill being tested can clearly select one and only one correct response.

☐ All extraneous material has been edited from the stem.

☐ All item distractors are plausible to someone who has not mastered the skill being measured.

☐ Answer choices are free of repetitious words or expressions that can be included in the stem.

☐ All answer choices are consistent with the stem both conceptually and grammatically as well as consistent with each other.

☐ All answer choices are mutually exclusive.

☐ All answer choices in the item are approximately equal in length (i.e., no one choice is much longer or shorter than another).

☐ No outliers - answer choices that are obviously different from the others.

☐ The correct response for the item has been indicated.

☐ Art has been conceptualized and sketched for the item, if applicable.

☐ The passage/stimulus associated with the item has been provided.

Checklist for Item Development

☐ The item matches content and format specifications.

☐ The item deals with material that is important in testing the appropriate strand.

☐ The item is free of gender, ethnic, racial, or other bias.

☐ The content of the item is grade-appropriate.

☐ The thinking skills demanded of the student are grade-appropriate.

☐ The reading level of the item strand and answer choices is suitable for the students being tested.

☐ All factual information has been checked and documented against reliable, up-to-date sources.

☐ The student can answer the question or complete the statement without looking at the answer choices.

☐ A student possessing the skill being tested can clearly select one and only one correct response.

☐ All item distractors are plausible to someone who has not mastered the skill being measured.

☐ The item stem presents only one question or statement.

☐ The item stem does not present clues to the correct response of the item.

☐ The item (stem and/or answer choices) does not present clues to the correct response to any other item that is in the same set of choices.

☐ All extraneous material has been edited from the stem.

☐ Answer choices are free of repetitious words or expressions that can be included in the stem.

☐ All answer choices are consistent with the stem both conceptually and grammatically as well as consistent with each other.

☐ All answer choices in the item are approximately equal in length (i.e., no one choice is much longer or shorter than another; in math, from low to high or vice-versa).

☐ All answer choices are mutually exclusive.

☐ No outliers (responses that are obviously different from the others):

  ☐ Responses all similar in meaning.

  ☐ Responses either all similar in length or two are long and two are short.

☐ Answer choices should not all begin with the same word - if this happens, include the word or words in the stem.

☐ Items phrased clearly and simply (check words that you suspect are too difficult a reading level against some word list).

☐ Check for similarity of items, repeated items, or items that give clues to other items.

- ☐ Check whether any material is copyrighted and, if so, indicate source so permission can be obtained.
- ☐ Reasonable representation of economic classes, races, ages, sexes, and handicapped in text and art:
  - ☐ Variety of above graphics.
  - ☐ Non-stereotypic representation.
  - ☐ Watch middle- and upper-economic level bias.
- ☐ Check to see that opinions are not masquerading as facts.
- ☐ Junk food?
- ☐ Is the material too dated for audience?
- ☐ The negative form of the stem has been used only if absolutely necessary.
- ☐ Key words (e.g., best, first, not, etc.) are formatted according to specifications (underlined, capitalized, italicized, left alone).
- ☐ The correct response for the item has been indicated.
- ☐ Art has been conceptualized for the item, if applicable.
- ☐ Position and type of art is indicated.
- ☐ Each piece of art is described in words and/or pictures.
- ☐ Descriptions of each piece of art are specific and unambiguous.
- ☐ Rules are clear, straight, of desired width and length. Sides drawn proportionally.
- ☐ Art has been checked against the corresponding item. Art or item has been revised, if necessary.
- ☐ Figures and tables are accurate, factual, and documented if appropriate.
- ☐ Males and females are represented equally in the art.
- ☐ Ethnic groups are represented equitably and non-stereotypically in the art.

The passage/stimulus/graphic associated with the item has been indicated.

NOTE: Use your project checklist in addition to this checklist.

Sign Off

Name ______________________ Date ______________

Checklist for Scoring Rubrics/Scoring Guide

☐ Type of scoring for each scorable unit has been identified.

☐ A scoring rubric has been identified for each scorable unit prior to or simultaneously with item development.

☐ The performance criterion (outcome/strand to be assessed) has been identified for each scorable unit.

☐ All forseeable correct responses have been identified.

☐ A scale (no. of points) has been identified for each scorable unit.

☐ Score points have been defined for each scorable unit (e.g., 4 = outstanding).

☐ Score points are clearly distinguishable from one another.

☐ The rubric allows full credit for answers dependent on earlier responses, even if the earlier response is incorrect.

☐ When more than one student behavior is required by an activity, the rubric clearly distinguishes among the behaviors and indicates how each is to be scored.

☐ The rubric focuses on performance (i.e., what the student did) and not on the performer (i.e., what the student understands).

☐ The language of the rubric is clear, consistent, and unambiguous.

☐ Any changes to scoring rubrics have been checked against the corresponding item.

☐ Scoring rubrics have been revised if any revisions occurred in the corresponding item.

Sign Off

Name ______________________________ Date ______________

Suggested Resources For Use in Item Development

1. Atlas
2. Almanac
3. Guinness Book of World Records
4. Encyclopedias
5. Michigan Maps
6. Michigan History Books
7. USA TODAY Graphic or Data Information
8. NCTM Grades 5-8 Addenda Series
9. Other Mathematics Resource Materials

Michigan Mathematics HSPT

Item Type: Multiple-Choice or Constructed-Response

Writer's Item #______________ Page ______

Item ID: ______________________	Art Slug: ______________________
Writer: ______________________	Strand: ______________________
Date: ______________________	Outcomes: ______________________
Item Type: (Circle One) MC or CR	Others: ______________________

Secure Test Materials - Do Not Duplicate For Any Reason
Michigan Department of Education ◆ CTB McGraw-Hill

Michigan Mathematics HSPT
Constructed-Response Exemplar

Writer's Item #______________ Page ______

Item ID: ____

Item Writer: ____________________________________

Constructed-Response Exemplar(s):

Michigan Mathematics HSPT
Constructed-Response Rubric

Writer's Item #____________ Page _____

Item ID: ____________________________
Item Writer: ____________________________
Scoring Model: ____________________________ (4 pt.)

Constructed-Response Rubric:

Appendix B

Table 8. Michigan HSPT in Mathematics Tryout
Raw Score Statistics by Form
Michigan 1995

		# Scored	Raw Score				P-Value[1]			IT[2]		Collapsed Levels		
Grp	Form	Items	N	Mean	%MS[3]	SD	a	90th	10th	90th	10th	Item #	From	To
1	11	47	580	28.6	37	14.7	.88	.79	.14	.48	.17	24	9	8
5	-	47	444	32.4	42	14.9	.87					–	–	–
1	12	47	570	31.7	35	18.6	.89	.72	.28	.54	.19	24	9	8
5	-	47	445	34.1	37	17.5	.87					22	11	10
												24	9	8
												27	11	10
1	13	47	577	36.5	40	20.2	.88	.83	.22	.55	.26	26	11	10
2		47	571	35.1	38	19.9	.88					25	11	10
												26	11	10
2	14	47	553	32.4	40	19.2	.88	.72	.22	.54	.21	23	9	8
6		47	610	37.3	41	19.9	.88					–	–	–
2	15	47	564	31.7	34	18.4	.88	.73	.27	.51	.11	22	11	10
												27	9	8
3		47	451	35.5	38	20.0	.88					27	9	8
3	16	47	444	40.3	45	20.9	.89	.75	.28	.53	.22	25	11	9
6		47	601	42.0	47	20.1	.88					25	11	10
3	17	47	452	37.3	41	22.0	89	.75	25	.55	.16	27	9	8
4		47	626	38.2	41	18.2	85					–	–	–
4	18	47	610	30.8	33	15.2	83	.81	.15	47	.14	23	9	6
												24	11	10
6		47	610	31.2	33	17.3	86					23	9	8
4	19	47	617	32.6	38	15.4	84	80	20	47	.14	–	–	–
5		47	447	32.6	38	15.0	84					23	7	6
												26	7	6

1 P-values for 90th and 10th percentile when items are sorted in order of p-values.

2 Items/test correlations for 90th and 10th percentile items.

3 Mean divided by maximum score (percentage of maximum score).

Table 9. Michigan HSPT in Mathematics Tryout
Summary of Fit Results - 1PL/PPC
Michigan 1995

				# of Misfit Items						Unest. Items	
Grp	Form	N	# of Scored Items	$Z \geq 10$	$10 > Z \geq 5$	$5 > Z \geq 3$	$3 > Z \geq 2$	Two Largest Z's		Number	Item #
1	11	571	47	4	8	12	8	93.6	50.3	0	
5		443	47	3	4	9	9	45.7	13.7	0	
1	12	570	47	5	10	7	6	45.4	16.6	0	
5		445	47	3	8	12	4	141.7	44.6	0	
1	13	557	47	5	8	9	3	103.4	99.8	0	
2		571	47	4	6	9	7	19.7	15.2	0	
2	14	548	47	2	13	7	9	14.3	11.4	0	
6		605	47	6	13	5	7	31.3	11.5	0	
2	15	564	47	5	8	5	7	35.9	25.0	0	
3		446	47	6	10	5	4	93.2	45.0	0	
3	16	441	47	7	6	9	7	23.9	17.4	0	
6		595	47	7	8	13	7	163.0	26.8	0	
3	17	445	47	3	10	9	7	21.7	19.6	1	25
4		619	47	3	11	6	5	15.8	11.7	0	
4	18	602	47	7	13	6	5	31.8	27.4	0	
6		602	47	8	11	5	3	20.7	17.4	0	
4	19	607	47	3	7	9	8	24.8	11.7	0	
5		447	47	3	7	8	5	32.4	15.5	0	

Table 10. Michigan HSPT in Mathematics Tryout
Summary of Fit Results - 3PL/2PPC
Michigan 1995

				# of Misfit Items						Unest. Items	
Grp	Form	# of Scored N	Items	Z≥10	10≥Z≥5	5≥Z≥3	3≥Z≥2	Two largest Z's		Item Number	#
1	11	571	47	1	1	2	3	10.2	8.5	2	14,29
5		443	47	0	2	2	3	5.7	5.6	2	14,29
1	12	552	47	0	1	3	7	6.8	4.5	0	
5		445	47	0	0	1	3	3.4	2.9	0	
1	13	557	47	1	1	3	6	204.2	7.2	0	34
2		566	47	0	1	3	2	5.8	4.3	0	
2	14	548	47	0	1	2	4	7.6	3.6	3	1*,32,44,46
6		605	47	0	1	4	3	5.7	3.7	0	
2	15	561	47	0	1	1	4	5.3	4.0	2	6,10
3		446	47	1	0	3	0	13.1	3.3	3	6,10,40
3	16	441	47	1	0	2	5	16.0	3.2	0	
6		595	47	1	1	2	5	10.5	6.0	1	15*
3	17	445	47	0	0	3	7	4.5	4.1	1	41
4		619	47	0	1	5	1	5.6	4.1	2	15*,19*
4	18	602	47	0	3	4	2	8.7	8.2	3	15,19*,41
6		602	47	0	1	9	4	5.1	4.8	2	12,41
4	19	607	47	0	1	2	8	6.6	4.7	2	11,17
5		447	47	1	0	2	4	16.0	4.3	5	11,17,38, 41*,44

* Item/test correlation > .08

Table 11. Michigan HSPT in Mathematics Tryout
Items Flagged for Deletion Under the Fit Criteria - 1PL/1PPC & 3PL/2PPC
Michigan 1995

		1PL/1PPC	3PL/2PPC		
Form	# Misfit Items[1]	Item Number[2]	# Misfit Items[1]	Item Number	NC[3]
11	10	3,8,14$,**23,25**,29$,32,34,37,39	1	1	2
12	14	2$,8,9,10,12,13,16,**22,24,25**,35,37,38,41	0		0
13	14	12,15,16,17,**22,23,24,25,27**,28,30,34$,36,47	0		1
14	14	2,8,10,14,18,**22,23,24,25**,32$,42,43,44$	0		4
15	12	4,6$,8,10$,12,16,19,**27**,34,38,45$,47	0		3
16	14	9,15,18,**22,23,25,27**,31,32$,33,36,47,41,45$	0		1
17	15[4]	8,10,12,14,15,19,**21,22,23**,29,30,32,33,37,41$	0		2
18	19	5,12$,15$,16,19,**21,23,26**,28,31,32,33,35,38,39, 41$,42,45	2	31,38	3
19	10	6,7,11$,17$,29,35,37,38$,44$,45	0		3

1 Note that each item has two z's, one from one sample and the other from a second sample. A "misfit" item is defined as follows:
(1) both z's$\geq$ 4.0, or
(2) (one $z > 4.0$), and ($4.0 \geq$ the other $z \geq 3.0$), and a plot of expected and observed curves fails to demonstrate reasonable fit.

Of the 122 items that were not fitted by the one-parameter model, 19 items fell into the latter category, (2). Of the three items not fitted by the 3PL/2PPC model, none fell in this category.

2 Bold numbers indicate constructed-response items.

3 Maximum number of non-convergent items in a given form taken by two samples.

4 One additional item, #25, could not be estimated in one sample.

$ Item/test correlation < .08 signifying low discrimination.

Table 12. Michigan HSPT in Mathematics Tryout
Mean and Standard Deviations of Discrimination - 3PL/2PPC
Michigan 1995

Form	Group	All Items			Multiple-Choice Only			Constructed-Response Only		
		# Items	Mean	S.D.	# Items	Mean	S.D.	# Items	Mean	S.D.
11	1	45	1.53	0.70	38	1.69	0.63	7	0.62	0.19
11	5	45	1.37	0.63	38	1.53	0.56	7	0.53	0.18
12	1	47	1.48	0.69	40	1.65	060	7	0.53	0.23
12	5	47	1.49	0.75	40	1.68	0.67	7	0.44	0.21
13	1	46	1.56	0.75	39	1.76	0.63	7	0.45	0.13
13	2	46	1.54	0.71	39	1.71	0.61	7	.056	0.21
14	2	43	1.56	0.67	36	1.77	0.50	7	0.45	0.06
14	6	43	1.53	0.67	36	1.74	0.51	7	0.43	0.06
15	2	44	1.35	0.58	37	1.50	0.51	7	0.57	0.16
15	3	44	1.51	0.75	37	1.69	0.68	7	0.56	0.16
16	3	46	1.72	0.80	39	1.93	0.69	7	0.58	0.11
16	6	46	1.95	1.79	39	2.17	0.63	7	0.71	0.14
17	3	44	1.70	.078	37	1.94	0.6	7	0.59	0.07
17	4	44	1.60	0.66	37	1.80	0.51	7	0.54	0.14
18	4	43	1.76	0.89	36	2.01	0.74	7	0.47	0.19
18	6	43	1.92	0.87	36	2.18	0.63	7	0.58	0.16
19	4	42	1.33	0.66	35	1.52	0.55	7	0.39	0.07
19	5	42	1.35	0.68	35	1.53	0.60	7	0.48	0.13
Total		801	1.57	0.75	675	1.77	0.65	126	0.53	0.17

Table 13. Michigan HSPT in Mathematics Tryout
Mean Form 13 Group 1 - Item Discrimination and Item Information Discrimination

Item	3PL/2PPC		Rasch
	Discrim(a)	Info	Info
1	1.56	146	180
2	1.96	184	180
3	2.21	202	180
4	1.48	133	180
5	1.82	163	180
6	1.37	120	180
7	1.89	169	180
8	1.68	156	180
9	1.31	129	180
10	3.00	359	180
11	3.00	408	180
12	2.70	269	180
13	2.58	207	180
14	1.98	178	180
15	2.97	270	180
16	0.92	63	180
17	3.02	450	180
18	1.41	130	180
19	1.42	128	180
20	1.27	114	180
21	0.53	478	1080
22	0.76	480	1080
23	0.52	585	1440
24	0.47	414	1080
25	0.43	792	1800
26	0.85	1327	1619
27	0.75	586	1080
28	2.74	299	180
29	1.88	182	180
30	3.00	359	180
31	1.97	180	180
32	1.90	189	180
33	2.18	184	180
35	2.69	328	180
36	2.95	216	180
37	2.23	181	180
38	2.02	268	180
39	3.00	196	180
40	1.91	139	180
41	1.42	213	180
42	2.42	224	180
43	2.27	267	180
44	2.53	153	180
45	1.62	220	180
46	2.39	325	180
47	3.00	400	180

Table 19. Michigan HSPT in Mathematics Tryout, 1994 Mantel-Haenszel Statistics
Chi-square & Standardized Mean Difference (SMD)
Reference: White or Male/Focal: Black or Female

Form 11

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	3.32	0.09	1.36	-0.03
2	1.29	0.08	0.08	-0.01
3	4.93	0.11	4.20	0.06
4	0.01	-0.01	10.89	-0.09
5	0.28	-0.04	0.89	0.03
6	2.94	-0.09	5.80	0.07
7	4.02	0.11	0.10	0.01
8	1.52	0.08	0.32	0.02
9	7.81	-0.14	7.29	-0.08
10	2.14	0.10	1.28	-0.04
11	0.04	0.01	0.21	0.01
12	0.27	-0.02	11.06	-0.07
13	0.03	-0.01	0.00	-0.01
14	2.05	0.08	1.05	0.03
15	0.04	0.02	4.83	-0.06
16	0.49	-0.02	1.49	0.02
17	1.17	0.06	3.74	0.04
18	0.19	-0.01	0.02	-0.02
19	2.85	0.08	0.24	0.01
20	6.01	-0.12	0.01	0.01
21	0.97	-0.11	2.76	0.09
22	2.99	0.15	0.01	0.02
23	4.94	-0.19	3.75	-0.13
24	0.01	-0.03	3.30	-0.11
25	0.90	0.08	9.27	0.16
26	8.53	0.28	1.67	0.06
27	0.15	-0.05	0.14	-0.01
28	0.07	0.03	2.70	0.04
29	1.58	0.06	0.08	-0.01
30	4.12	-0.10	6.42	-0.07
31	1.04	0.04	8.39	-0.07
32	0.69	0.06	1.21	0.03
33	0.95	0.06	9.98	0.09
34	5.25	0.11	1.98	-0.04
35	0.09	-0.02	0.60	-0.03
36	0.03	0.02	1.14	0.02
37	0.02	-0.01	0.70	-0.02
38	0.14	0.02	0.59	0.03
39	0.17	-0.02	10.17	-0.07
40	0.09	-0.03	0.37	-0.03
41	0.31	-0.04	16.71	-0.14
42	0.31	0.03	1.31	0.03
43	0.28	0.04	3.91	0.06
44	0.01	-0.01	4.77	0.06
45	0.99	0.06	4.69	0.07
46	0.63	-0.05	1.88	-0.04
47	0.17	0.03	0.18	-0.02

Form 12

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	9.13	0.15	4.60	0.04
2	0.00	-0.01	3.25	0.06
3	0.62	0.04	0.01	-0.01
4	0.00	0.00	0.14	-0.01
5	0.03	-0.01	17.43	-0.11
6	0.01	-0.01	1.76	0.06
7	0.19	-0.02	20.63	0.09
8	0.12	0.02	1.43	0.05
9	0.05	-0.01	5.89	-0.06
10	0.16	-0.03	0.02	-0.01
11	0.16	-0.03	2.43	-0.04
12	1.45	0.06	0.30	0.01
13	1.08	0.05	3.77	-0.06
14	0.04	-0.02	4.71	-0.08
15	0.20	-0.04	0.04	0.00
16	0.09	-0.03	24.26	-0.14
17	0.62	-0.04	0.90	-0.03
18	0.16	0.02	0.08	0.00
19	0.11	0.03	0.02	-0.01
20	0.30	0.03	0.34	-0.02
21	14.95	0.41	2.14	-0.09
22	1.00	-0.07	25.03	0.34
23	0.39	-0.03	0.01	-0.04
24	.061	-0.12	0.34	0.06
25	0.65	0.08	0.96	0.05
26	0.74	-0.06	1.73	-0.09
27	10.77	-0.40	1.30	0.09
28	1.60	-0.07	8.70	-0.08
29	0.83	0.04	0.69	-0.04
30	0.24	0.04	0.07	0.02
31	2.53	0.09	0.25	0.01
32	0.00	0.01	10.99	0.12
33	2.14	0.08	0.00	-0.01
34	2.49	-0.09	4.75	-0.07
35	1.49	-0.06	12.70	-0.09
36	0.08	0.02	0.19	-0.01
37	8.75	0.14	1.20	0.03
38	0.00	0.01	0.21	-0.02
39	0.00	-0.01	0.20	-0.02
40	1.61	-0.07	3.73	-0.05
41	5.31	0.13	1.69	0.04
42	1.62	-0.07	4.22	-0.06
43	0.03	-0.01	1.84	0.03
44	0.02	-0.01	21.53	0.11
45	2.06	0.07	0.00	0.00
46	0.05	-0.01	13.17	-0.11
47	0.14	-0.02	3.29	-0.03

Table 19. Michigan HSPT in Mathematics Tryout, 1994 Mantel-Haenszel Statistics (Cont'd)
Chi-square & Standardized Mean Difference (SMD)
Reference: White or Male/Focal: Black or Female

Form 13

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	0.22	-0.03	0.36	0.01
2	0.39	-0.03	5.42	-0.06
3	9.95	-0.15	1.22	-0.03
4	4.32	-0.11	1.58	-0.05
5	2.43	0.08	0.89	0.03
6	0.01	0.00	1.34	0.04
7	0.30	0.02	6.30	0.05
8	3.38	-0.08	5.56	-0.08
9	0.02	0.00	0.11	0.01
10	1.19	-0.04	10.74	-0.08
11	0.32	-0.01	0.08	0.00
12	0.23	0.03	0.10	0.01
13	1.37	-0.07	4.58	-0.06
14	0.28	0.03	1.31	-0.08
15	0.16	0.03	1.97	0.03
16	0.42	-0.05	1.32	0.04
17	0.04	0.02	1.41	-0.02
18	4.46	-0.11	0.00	-0.00
19	0.00	0.00	0.28	-0.02
20	2.69	-0.09	0.21	-0.02
21	0.23	0.01	0.94	0.06
22	0.76	0.09	0.10	0.02
23	1.01	-0.14	0.07	-0.01
24	0.02	-0.01	0.10	0.04
25	0.06	0.04	8.20	0.21
26	0.02	0.00	2.48	0.09
27	0.07	-0.01	4.75	-0.11
28	0.07	-0.02	0.78	0.02
29	0.01	-0.01	0.06	0.01
30	0.95	-0.04	1.96	-0.04
31	1.00	0.05	0.25	-0.02
32	7.40	0.14	8.62	0.07
33	0.70	-0.02	0.19	-0.02
34	1.35	-0.06	1.62	-0.03
35	1.51	-0.05	1.15	0.02
36	5.20	0.10	10.22	0.07
37	1.87	0.07	1.86	-0.04
38	0.54	-0.05	0.55	-0.02
39	4.38	0.07	0.51	0.03
40	0.78	0.05	6.08	-0.07
41	0.48	-0.04	3.66	-0.06
42	1.06	-0.05	5.64	0.07
43	9.62	0.15	0.31	0.02
44	0.54	0.05	2.96	0.04
45	0.58	-0.03	2.65	-0.05
46	1.02	-0.05	3.90	0.06
47	2.09	-0.06	4.09	-0.06

Form 14

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	6.25	0.10	7.35	0.06
2	0.00	-0.01	6.28	0.06
3	0.66	-0.04	0.70	0.02
4	0.01	0.01	1.60	-0.03
5	0.55	0.03	0.44	0.02
6	0.11	-0.01	13.69	-0.11
7	0.55	0.05	4.84	0.06
8	4.72	0.07	0.11	0.02
9	0.40	0.04	0.04	0.01
10	0.00	-0.02	0.01	-0.00
11	0.04	-0.02	1.55	-0.04
12	1.33	0.07	3.30	-0.06
13	0.74	0.04	0.86	0.02
14	0.94	-0.04	0.78	0.03
15	2.00	-0.05	0.04	-0.00
16	3.83	-0.08	10.72	-0.10
17	5.45	0.12	0.77	0.02
18	1.85	-0.09	1.24	-0.02
19	5.95	-0.10	10.49	-0.09
20	2.63	-0.06	1.12	-0.04
21	0.00	-0.01	9.23	0.13
22	0.10	0.03	1.52	-0.06
23	0.51	0.01	0.12	0.02
24	0.23	0.03	0.61	0.01
25	14.61	0.52	0.14	-0.02
26	0.17	-0.04	1.80	-0.09
27	12.73	0.34	6.01	0.15
28	0.60	0.05	2.48	-0.05
29	0.46	0.05	19.84	0.09
30	0.22	0.04	0.00	0.00
31	0.08	0.03	0.95	0.02
32	5.29	0.08	4.27	0.05
33	0.91	-0.03	2.54	-0.03
34	0.03	0.02	14.60	-0.10
35	0.35	0.05	1.16	0.04
36	0.23	0.04	6.77	-0.07
37	0.01	0.01	1.09	0.03
38	2.36	0.06	1.54	0.03
39	1.00	0.04	2.65	-0.04
40	0.61	-0.05	1.76	-0.04
41	1.06	0.05	1.95	0.04
42	0.05	-0.01	0.00	0.00
43	2.69	-0.04	0.04	-0.01
44	0.64	-0.03	6.17	-0.03
45	0.00	0.03	7.37	0.08
46	2.70	-0.05	0.01	0.00
47	5.49	-0.13	1.06	0.03

Table 19. Michigan HSPT in Mathematics Tryout, 1994 Mantel-Haenszel Statistics (Cont'd)
Chi-square & Standardized Mean Difference (SMD)
Reference: White or Male/Focal: Black or Female

Form 15

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	2.91	-0.09	13.19	-0.10
2	0.90	-0.04	11.49	-0.11
3	0.00	-0.02	0.86	0.02
4	1.93	0.09	10.68	0.09
5	2.11	0.08	0.95	0.02
6	0.64	0.04	7.79	-0.06
7	1.67	-0.05	3.16	-0.07
8	0.00	0.00	0.47	-0.02
9	0.00	-0.02	1.79	0.04
10	4.31	0.09	3.00	-0.05
11	0.17	0.05	0.34	-0.03
12	1.55	-0.06	1.26	-0.04
13	1.10	-0.06	5.66	0.07
14	3.92	0.12	1.27	0.03
15	0.01	-0.02	0.35	0.03
16	0.28	0.05	9.37	-0.09
17	0.50	0.05	0.94	0.03
18	0.01	0.01	1.16	0.03
19	0.90	0.09	3.68	-0.06
20	0.00	0.02	0.52	-0.02
21	4.01	-0.15	3.65	0.09
22	0.02	-0.03	0.31	-0.04
23	2.53	0.19	0.61	-0.07
24	1.19	-0.11	0.34	-0.01
25	9.79	0.22	0.10	0.02
26	0.02	-0.02	0.89	0.05
27	1.09	-0.15	0.25	-0.01
28	0.43	0.06	3.22	0.07
29	4.03	-0.11	21.41	-0.14
30	0.74	0.04	9.36	-0.07
31	1.66	0.06	7.17	0.07
32	0.03	-0.01	0.19	0.00
33	1.20	0.05	2.71	-0.04
34	0.32	0.04	4.37	-0.07
35	1.31	-0.07	3.40	0.06
36	0.30	0.02	0.16	-0.03
37	2.46	0.08	1.02	0.02
38	1.59	0.06	0.22	-0.01
39	0.29	0.01	2.05	0.04
40	0.01	0.01	1.47	-0.04
41	0.04	0.01	0.65	0.02
42	3.30	0.10	0.00	0.01
43	0.00	-0.03	0.00	0.00
44	2.72	0.07	2.46	0.05
45	0.55	-0.05	2.98	0.06
46	2.28	0.05	2.65	0.04
47	5.35	0.12	0.10	-0.01

Form 16

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	0.00	-0.04	0.74	-0.02
2	5.74	0.13	0.00	-0.01
3	0.44	-0.05	0.74	-0.02
4	0.07	0.00	1.92	-0.04
5	0.33	0.00	0.37	-0.02
6	7.78	0.15	3.23	0.05
7	0.01	0.02	4.08	-0.05
8	0.00	0.01	2.15	-0.04
9	0.02	0.01	4.19	-0.04
10	1.27	0.04	5.13	-0.05
11	1.87	0.07	4.59	-0.06
12	2.79	0.11	6.16	0.07
13	7.18	0.12	0.08	0.01
14	0.69	0.04	0.88	-0.03
15	0.34	0.02	0.00	0.00
16	1.87	0.05	3.91	0.05
17	0.98	-0.04	3.60	0.06
18	1.60	-0.09	1.02	-0.03
19	4.87	-0.14	3.01	-0.05
20	0.00	-0.02	0.57	0.04
21	0.11	0.02	10.01	0.11
22	0.05	-0.11	2.42	-0.10
23	0.04	-0.02	11.36	0.19
24	2.06	-0.10	2.33	-0.10
25	0.19	0.02	0.92	0.07
26	0.07	-0.05	1.05	0.09
27	1.00	-0.06	0.18	0.04
28	0.02	0.02	2.51	-0.05
29	0.82	0.09	0.45	0.02
30	0.06	0.01	1.15	-0.05
31	0.44	0.02	2.53	0.03
32	0.96	0.04	0.33	0.02
33	0.09	-0.07	0.00	0.01
34	2.38	0.09	0.12	-0.02
35	2.88	0.03	2.49	-0.05
36	1.03	0.05	0.76	-0.02
37	0.13	0.03	0.12	0.00
38	0.98	-0.03	0.16	0.02
39	0.01	-0.01	1.33	-0.03
40	0.71	0.02	5.29	-0.07
41	0.01	0.04	0.38	-0.02
42	2.31	-0.09	0.85	-0.03
43	0.51	-0.03	4.21	0.06
44	0.78	0.04	2.89	-0.06
45	0.46	-0.03	0.60	-0.02
46	0.00	-0.01	0.33	-0.02
47	3.60	-0.13	5.39	-0.07

Table 19. Michigan HSPT in Mathematics Tryout, 1994 Mantel-Haenszel Statistics (Cont'd)
Chi-square & Standardized Mean Difference (SMD)
Reference: White or Male/Focal: Black or Female

Form 17

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	0.12	-0.03	4.19	-0.05
2	3.23	-0.12	1.56	-0.03
3	0.43	-0.07	26.99	-0.14
4	0.69	-0.06	0.64	-0.03
5	0.10	0.01	8.64	-0.07
6	0.29	0.05	0.08	0.00
7	1.51	0.07	0.10	0.00
8	0.99	0.06	1.97	-0.03
9	7.03	0.17	0.03	-0.01
10	0.27	-0.02	12.12	-0.06
11	0.23	0.05	7.04	0.08
12	1.86	-0.08	2.51	-0.04
13	0.04	0.00	7.60	0.04
14	0.03	0.01	0.20	-0.01
15	0.48	-0.04	0.31	0.01
16	0.01	-0.02	6.69	-0.09
17	2.50	0.11	0.04	-0.01
18	0.12	0.01	5.34	-0.06
19	0.35	0.06	0.28	0.02
20	0.00	0.02	0.60	-0.02
21	0.55	0.14	4.07	-0.15
22	1.40	0.23	2.87	0.06
23	0.46	-0.08	0.83	0.07
24	0.79	-0.05	1.60	0.07
25	0.15	0.05	4.02	-0.15
26	0.08	0.08	15.35	0.33
27	0.68	0.16	0.49	-0.02
28	3.26	0.15	7.09	-0.08
29	0.20	-0.06	0.00	0.00
30	0.02	-0.02	0.70	0.02
31	1.45	0.09	0.19	0.02
32	0.42	0.06	0.04	0.01
33	0.80	-0.05	1.02	-0.02
34	0.00	-0.01	1.47	-0.04
35	0.46	-0.05	2.39	-0.05
36	0.04	0.03	0.36	-0.02
37	1.70	0.09	2.02	-0.04
38	0.01	-0.01	0.28	-0.03
39	0.44	0.04	1.29	-0.03
40	0.37	-0.07	2.22	0.04
41	0.27	-0.02	0.11	0.02
42	0.01	-0.01	0.87	-0.04
43	1.46	0.10	0.16	0.01
44	0.00	0.04	2.53	0.04
45	1.81	0.08	3.12	0.04
46	2.75	0.10	1.46	0.03
47	0.87	0.08	0.61	0.03

Form 18

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	0.00	0.01	3.70	0.04
2	0.01	0.01	0.00	0.00
3	0.00	-0.02	1.08	-0.03
4	0.09	-0.02	1.54	0.04
5	0.61	0.06	10.08	0.07
6	1.46	0.09	0.09	0.01
7	0.02	-0.01	0.77	0.02
8	2.21	0.07	6.85	-0.06
9	0.03	-0.01	7.49	0.05
10	0.87	0.07	1.57	-0.03
11	1.25	0.08	2.98	0.05
12	0.15	-0.02	4.91	-0.04
13	0.97	0.08	1.21	0.03
14	2.96	-0.07	16.38	-0.08
15	0.04	-0.02	1.04	0.03
16	1.52	0.09	0.21	-0.01
17	1.16	0.07	4.17	0.05
18	3.04	0.13	0.05	0.01
19	1.19	-0.08	2.02	-0.04
20	0.19	-0.04	1.97	0.03
21	0.70	-0.08	39.54	-0.26
22	0.78	-0.11	0.03	0.00
23	0.52	-0.11	9.66	0.19
24	0.33	-0.09	8.83	0.20
25	0.15	0.05	0.59	0.04
26	7.08	0.54	0.61	-0.08
27	0.62	-0.13	0.17	0.05
28	0.16	-0.04	0.48	0.02
29	0.05	0.02	0.21	-0.01
30	1.50	0.09	12.44	-0.09
31	2.31	0.10	13.72	0.09
32	0.00	-0.01	2.63	0.04
33	0.56	-0.06	1.11	-0.02
34	2.64	-0.12	19.61	-0.14
35	0.83	0.07	1.36	0.03
36	3.16	0.13	3.28	-0.06
37	0.16	-0.04	0.77	-0.03
38	0.00	-0.02	7.05	-0.07
39	0.01	0.00	1.42	-0.03
40	3.64	0.13	6.89	0.08
41	2.94	0.13	2.53	-0.03
42	0.02	0.01	2.55	0.04
43	6.67	-0.20	1.38	0.04
44	1.52	0.07	8.29	-0.09
45	1.05	-0.07	0.00	-0.01
46	2.03	-0.11	8.74	-0.09
47	1.13	0.07	0.27	0.02

Table 19. Michigan HSPT in Mathematics Tryout, 1994 Mantel-Haenszel Statistics (Cont'd)
Chi-square & Standardized Mean Difference (SMD)
Reference: White or Male/Focal: Black or Female

Form 19

Item	ethnic chi sq.	ethnic SMD	gender chi sq.	gender SMD
1	0.12	0.03	0.58	0.01
2	0.00	0.00	2.72	0.05
3	0.03	0.02	0.00	0.00
4	0.27	0.02	0.01	0.00
5	1.23	-0.08	0.88	0.02
6	0.32	-0.03	0.69	0.02
7	0.05	-0.03	3.06	-0.06
8	9.00	0.18	0.71	0.03
9	1.09	-0.06	0.00	0.00
10	1.69	0.07	6.04	-0.07
11	0.00	0.00	0.42	0.02
12	0.06	0.03	0.16	0.02
13	0.84	0.04	0.16	-0.01
14	0.18	0.03	0.58	-0.03
15	0.63	0.06	4.13	0.08
16	6.36	-0.15	0.50	-0.02
17	1.20	0.07	2.32	0.03
18	0.73	-0.06	0.08	0.02
19	0.00	0.00	0.27	-0.01
20	1.17	-0.08	0.78	0.03
21	0.04	-0.03	0.19	-0.02
22	2.33	0.21	4.49	0.10
23	0.51	0.06	0.68	-0.05
24	0.35	-0.07	2.39	-0.09
25	0.16	-0.02	.074	-0.01
26	8.09	0.18	2.45	0.04
27	10.65	-0.31	14.04	-0.18
28	0.01	0.00	0.49	0.03
29	1.16	-0.07	0.05	-0.02
30	0.01	0.01	0.03	-0.01
31	0.06	-0.02	1.58	0.02
32	1.82	0.07	2.89	0.06
33	0.05	-0.02	1.77	-0.05
34	1.25	-0.07	0.95	-0.03
35	0.07	-0.02	0.06	-0.01
36	6.33	0.15	0.72	0.03
37	0.71	0.06	9.63	-0.09
38	1.63	0.08	0.41	0.02
39	0.38	-0.05	1.37	-0.04
40	3.28	-0.11	0.02	0.00
41	1.69	-0.05	12.17	-0.09
42	0.22	-0.04	2.72	-0.05
43	1.41	-0.08	20.86	0.15
44	0.68	0.05	0.22	-0.01
45	0.18	-0.02	0.83	-0.02
46	2.72	-0.10	0.06	0.01
47	0.00	0.01	4.05	0.05

Michigan High School Proficiency Test
Mathematics Tryout
Teacher Comment Sheet

As part of the Michigan HSPT Mathematics tryout, the Michigan Department of Education is asking you to complete the following comment sheet.

Directions: Please answer each of the following to the **BEST** of your ability. Each item can be answered by the person administering the HSPT Mathematics tryout. None of the items are specific to any particular form. IF YOU NEED MORE SPACE TO RESPOND, PLEASE USE THE BACK OF THESE SHEETS OR ATTACH YOUR OWN.

1. Was the Administration Manual clear, easy to use, and complete? ______Yes ______No
   If "No," what changes would you suggest?

____

____

____

____

2. Did you have a sufficient number of test materials? ______Yes ______No
   If "No," which ones were insufficient?______________________________

____

3. Within the time permitted, approximately what percentage of your students finished:

   Part I________% Part II________%

4. Did the students have any difficulty using the Reference Table or Transparency Overlay?

   ______Yes ______No If Yes, please be specific.

____

____

____

5. What comments, concerns, or issues did students raise about the constructed-response item exercises?

____

____

____

6. What percentage of the students used a calculator to answer any of the exercises? _____%

Michigan High School Proficiency Test
Mathematics Tryout
Teacher Comment Sheet (cont.'d)

7. Did your school district provide calculators to use on this tryout test? ____Yes ______No

8. Was the reading level of the exercises, both multiple choice and constructed response, appropriate for grade 11? ______Yes ______No If No, please comment.

9. In this section provide your ideas, critique, etc., on this tryout. Please include student reactions to exercises as well as your overview of the entire test.

THANK YOU FOR YOUR TIME AND EFFORT IN RESPONDING TO THESE QUESTIONS.

Appendix C

Table 21. Michigan HSPT in Mathematics Pilot
Descriptive Statistics by Form
Michigan 1995

Form	Set of Pilot Form	# of Scored Items	# of Points	Mean	s.d.	N	α	P-value[1]		Item-Test Correlation	
								Mean	s.d.	Mean	s.d.
4	-	46	61	31.66	12.61	1122	.90	.52	.21	.43	.14
	1	-		31.68	12.79	586	-	-	-	-	-
	4	-		31.63	12.40	536	-	-	-	-	-
5	-	46	61	30.14	12.70	1255	.91	.49	.21	.45	.11
	1	-		30.35	12.78	577	-	-	-	-	-
	5	-		29.96	12.62	678	-	-	-	-	-
6	-	46	61	31.18	12.82	1217	.91	.51	.21	.45	.13
	1	-		31.76	12.78	581	-	-	-	-	-
	2	-		30.65	12.82	636	-	-	-	-	-
7	-	46	61	32.00	12.20	1213	.90	.52	.20	.45	.10
	2	-		32.13	12.56	630	-	-	-	-	-
	6	-		31.86	11.79	583	-	-	-	-	-
8	-	46	61	32.23	13.67	1383	.91	.53	.22	.45	.15
	2	-		31.46	13.60	632	-	-	-	-	-
	3	-		32.89	13.69	751	-	-	-	-	-
9	-	46	61	31.96	12.64	1404	.91	.52	.21	.45	.11
	3	-		33.26	12.91	740	-	-	-	-	-
	5	-		30.52	12.16	664	-	-	-	-	-
10	-	46	61	32.69	12.47	1261	.90	.54	.20	.43	.13
	3	-		33.58	13.00	733	-	-	-	-	-
	4	-		31.46	11.57	528	-	-	-	-	-
11	-	46	61	32.39	11.72	1105	.90	.53	.19	.43	.13
	4	-		31.78	11.66	533	-	-	-	-	-
	6	-		32.96	11.75	572	-	-	-	-	-

[1] Includes p-value for constructed-response items obtained by dividing the average score by the maximum number of points.

Table 22. Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 4 ITEM	TYPE*	N	P VAL	RAW MEAN	STDV
1	M	1122	0.58200	0.58200	0.49345
2	M	1122	0.82353	0.82353	0.38139
3	M	1122	0.63191	0.63191	0.48250
4	M	1122	0.35561	0.35561	0.47891
5	M	1122	0.43226	0.43226	0.49561
6	M	1122	0.73084	0.73084	0.44372
7	M	1122	0.68449	0.68449	0.46493
8	M	1122	0.23797	0.23797	0.42603
9	M	1122	0.63815	0.63815	0.48075
10	M	1122	0.47683	0.47683	0.49969
11	M	1122	0.57219	0.57219	0.49498
12	M	1122	0.81907	0.81907	0.38513
13	M	1122	0.30749	0.30749	0.46166
14	M	1122	0.77540	0.77540	0.41750
15	M	1122	0.81283	0.81283	0.39022
16	M	1122	0.86096	0.86096	0.34614
17	M	1122	0.72282	0.72282	0.44781
18	M	1122	0.60606	0.60606	0.48884
19	M	1122	0.88414	0.88414	0.32021
20	M	1122	0.75490	0.75490	0.43034
21	O	1122	0.53030	1.59091	1.44022
22	O	1122	0.41123	2.05615	1.84779
23	O	1122	0.38859	1.16578	1.16182
24	O	1122	0.15241	0.30481	0.60606
25	O	1122	0.35205	1.40820	1.50321
26	O	1122	0.18204	0.72816	1.16141
27	M	1122	0.62210	0.62210	0.48506
28	M	1122	0.81640	0.81640	0.38733
29	M	1122	0.42424	0.42424	0.49445
30	M	1122	0.86631	0.86631	0.34047
31	M	1122	0.55348	0.55348	0.49735
32	M	1122	0.57843	0.57843	0.49403
33	M	1122	0.72014	0.72014	0.44913
34	M	1122	0.69786	0.69786	0.45939
35	M	1122	0.57308	0.57308	0.49485
36	M	1122	0.75579	0.75579	0.42981
37	M	1122	0.71925	0.71925	0.44957
38	M	1122	0.47683	0.47683	0.49969
39	M	1122	0.39305	0.39305	0.48865
40	M	1122	0.57932	0.57932	0.49389
41	M	1122	0.67201	0.67201	0.46969
42	M	1122	0.67201	0.67201	0.46969
43	M	1122	0.47415	0.47415	0.49955
44	M	1122	0.37790	0.37790	0.48508
45	M	1122	0.37701	0.37701	0.48485
46	M	1122	0.34225	0.34225	0.47467

* M=Multiple-Choice Item. O=Constructed-Response Item

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 4 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN_M3	QUIN_M4	QUIN_M5
1	M	1122	0.40359	0.42194	0.49065	0.73820	0.86512
2	M	1122	0.55157	0.78059	0.91589	0.91845	0.95814
3	M	1122	0.26906	0.52321	0.64019	0.79828	0.93953
4	M	1122	0.14350	0.17722	0.29439	0.50215	0.67442
5	M	1122	0.26009	0.43038	0.45327	0.48069	0.53953
6	M	1122	0.47534	0.67511	0.77103	0.79828	0.94419
7	M	1122	0.38117	0.57384	0.71963	0.81545	0.94419
8	M	1122	0.17937	0.14346	0.15888	0.26180	0.45581
9	M	1122	0.29596	0.43367	0.66822	0.80258	0.94419
10	M	1122	0.32287	0.35021	0.43925	0.51502	0.77209
11	M	1122	0.23767	0.38819	0.57944	0.77253	0.89767
12	M	1122	0.43498	0.77637	0.90654	0.98283	1.00000
13	M	1122	0.25561	0.22785	0.22430	0.29614	0.54419
14	M	1122	0.49327	0.78903	0.79439	0.85408	0.94884
15	M	1122	0.47982	0.75105	0.88318	0.96996	0.98605
16	M	1122	0.62332	0.82700	0.92056	0.94850	0.99070
17	M	1122	0.30493	0.68354	0.84112	0.86266	0.93023
18	M	1122	0.31390	0.42191	0.64019	0.74678	0.92558
19	M	1122	0.71749	0 86498	0.91589	0.95279	0.97209
20	M	1122	0.43062	0.69198	0.82243	0.87554	0.96279
21	O	1122	0.07462	0.65401	1.73364	2.61373	2.94419
22	O	1122	0.18386	0.88608	1.81308	3.17597	4.31628
23	O	1122	0.13004	0.55274	1.02336	1.71245	2.46512
24	O	1122	0.04933	0.11392	0.19626	0.35622	0.83256
25	O	1122	0.17040	0.54430	1.14953	2.06438	3.19070
26	O	1122	0.04036	0.32068	0.42056	0.94850	1.95814
27	M	1122	0.42152	0.56118	0.59813	0.72532	0.80930
28	M	1122	0.49776	0.77215	0.88785	0.94850	0.98140
29	M	1122	0.12108	0.22363	0.39252	0.57511	0.82791
30	M	1122	0.62780	0.85654	0.91589	0.95279	0.98140
31	M	1122	0.17040	0.43882	0.60748	0.72961	0.83256
32	M	1122	0.26906	0.44304	0.61215	0.72532	0.85581
33	M	1122	0.37668	0.62869	0.78037	0.85837	0.96744
34	M	1122	0.37668	0.57384	0.75701	0.86266	0.93023
35	M	1122	0.26906	0.45570	0.60748	0.72103	0.82326
36	M	1122	0.45291	0.63713	0.78505	0.93133	0.98140
37	M	1122	0.33184	0.62869	0.77570	0.88841	0.98140
38	M	1122	0.22870	0.25316	0.46262	0.64378	0.81395
39	M	1122	0.30045	0.33755	0.39252	0.36052	0.58605
40	M	1122	0.38117	0.51477	0.57009	0.62661	0.81395
41	M	1122	0.31390	0.51899	0.75701	0.82403	0.96279
42	M	1122	0.29148	0.60759	0.70093	0.81974	0.94884
43	M	1122	0.24664	0.30380	0.42991	0.60944	0.79535
44	M	1122	0.12108	0.21519	0.30374	0.52361	0.73953
45	M	1122	0.17489	0.19831	0.28505	0.51502	0.72558
46	M	1122	0.19731	0.33333	0.27570	0.35622	0.55349

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 4

ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1122	0.36255	-0.18394	0.36255	-0.21188	-0.07982
2	M	1122	0.36738	-0.08836	-0.22080	-0.27458	0.36738
3	M	1122	0.47764	-0.28725	-0.19315	-0.23676	0.47764
4	M	1122	0.42336	-0.22221	-0.28573	0.42336	-0.12872
5	M	1122	0.17979	-0.17672	0.17979	0.06423	-0.14694
6	M	1122	0.34766	-0.13653	-0.25166	-0.17241	0.34766
7	M	1122	0.42321	-0.23217	-0.22315	0.42321	-0.19983
8	M	1122	0.23435	-0.26755	0.23435	-0.14555	0.29632
9	M	1122	0.47488	-0.28773	0.47488	-0.18358	-0.25605
10	M	1122	0.30585	-0.28343	-0.22235	0.30555	-0.14993
11	M	1122	0.49144	-0.20756	0.49144	-0.25186	-0.23652
12	M	1122	0.49696	-0.22231	-0.32401	-0.24993	0.49896
13	M	1122	0.22483	0.06150	-0.27852	0.22483	-0.28481
14	M	1122	0.34786	-0.19452	-0.25330	-0.14391	0.34788
15	M	1122	0.45852	-0.22477	-0.30464	0.45852	-0.21249
16	M	1122	0.36159	-0.18978	-0.24707	0.36159	-0.16669
17	M	1122	0.45784	-0.12561	0.45784	-0.34831	-0.20806
18	M	1122	0.44947	-0.31418	0.44947	-0.11700	-0.20731
19	M	1122	0.28422	0.28422	-0.17248	-0.09768	-0.19245
20	M	1122	0.42671	0.42671	-0.21307	-0.28449	-0.18098
21	O	1122	0.75153				
22	O	1122	0.81680				
23	O	1122	0.72172				
24	O	1122	0.44923				
25	O	1122	0.72269				
26	O	1122	0.57195				
27	M	1122	0.28230	-0.15333	0.28230	-0.13370	-0.14997
28	M	1122	0.42896	-0.22331	-0.25041	0.42896	-0.22660
29	M	1122	0.50795	-0.28633	-0.20218	-0.17613	0.50795
30	M	1122	0.34997	-0.19771	-0.22267	0.34997	-0.15499
31	M	1122	0.46831	-0.33643	-0.28259	-0.11865	0.46831
32	M	1122	0.41903	0.41903	-0.20868	-0.23663	-0.15059
33	M	1122	0.45837	-0.28095	-0.22535	-0.22024	0.45837
34	M	1122	0.43696	-0.20235	0.43696	-0.26358	-0.20602
35	M	1122	0.41118	0.41118	-0.26406	-0.14098	-0.19979
36	M	1122	0.45082	-0.25991	-0.29668	0.45082	-0.15750
37	M	1122	0.49814	-0.21012	0.49814	-0.23586	-0.31168
38	M	1122	0.46206	-0.19481	-0.25834	-0.19199	0.46206
39	M	1122	0.17900	-0.07000	-0.18374	0.17900	0.02518
40	M	1122	0.29179	0.29179	-0.19419	-0.08128	-0.16758
41	M	1122	0.47705	-0.25828	-0.25297	0.47705	-0.19978
42	M	1122	0.46381	-0.29477	-0.25570	0.46381	-0.11742
43	M	1122	0.42128	0.42128	-0.13531	-0.19050	-0.22440
44	M	1122	0.46253	-0.16550	-0.21653	-0.16258	0.46253
45	M	1122	0.41705	-0.17456	-0.25288	-0.12764	0.41705
46	M	1122	0.23586	-0.10546	-0.07997	0.23586	-0.09091

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 5

ITEM	TYPE	N	P VAL	RAW MEAN	STDV
1	M	1255	0.78327	0.78327	0.41218
2	M	1255	0.49084	0.49084	0.50012
3	M	1255	0.44462	0.44462	0.49712
4	M	1255	0.80398	0.80398	0.39714
5	M	1255	0.57849	0.57849	0.49400
6	M	1255	0.47092	0.47092	0.49935
7	M	1255	0.90040	0.90040	0.29959
8	M	1255	0.70598	0.70598	0.45578
9	M	1255	0.34661	0.34661	0.47608
10	M	1255	0.70598	0.70598	0.45578
11	M	1255	0.62151	0.62151	0.48520
12	M	1255	0.71793	0.71793	0.45019
13	M	1255	0.21673	0.21673	0.41218
14	M	1255	0.45418	0.45418	0.49809
15	M	1255	0.64143	0.64143	0.47977
16	M	1255	0.63745	0.63745	0.48093
17	M	1255	0.80717	0.80717	0.39468
18	M	1255	0.69402	0.69402	0.46100
19	M	1255	0.53705	0.53705	0.49882
20	M	1255	0.57291	0.57291	0.49485
21	O	1255	0.47570	0.95139	0.91157
22	O	1255	0.36773	1.47092	1.61647
23	O	1255	0.14390	0.71952	1.57210
24	O	1255	0.36228	1.08685	1.07440
25	O	1255	0.37822	1.13466	1.16578
26	O	1255	0.17789	0.71155	1.07144
27	M	1255	0.86454	0.86454	0.34235
28	M	1255	0.77291	0.77291	0.41912
29	M	1255	0.50199	0.50199	0.50020
30	M	1255	0.44781	0.44781	0.49747
31	M	1255	0.79124	0.79124	0.40659
32	M	1255	0.51315	0.51315	0.50003
33	M	1255	0.25896	0.25896	0.43824
34	M	1255	0.42709	0.42709	0.49485
35	M	1255	0.84701	0.84701	0.36012
36	M	1255	0.67331	0.67331	0.46919
37	M	1255	0.63586	0.63586	0.48138
38	M	1255	0.47649	0.47649	0.49965
39	M	1255	0.71155	0.71155	0.45322
40	M	1255	0.55219	0.55219	0.49747
41	M	1255	0.68287	0.68287	0.46554
42	M	1255	0.60956	0.60956	0.48804
43	M	1255	0.76335	0.76335	0.42520
44	M	1255	0.50677	0.50677	0.50015
45	M	1255	0.39124	0.39124	0.48822
46	M	1255	0.50518	0.50518	0.50017

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 5 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN_M3	QUIN_M4	QUIN_M5
1	M	1255	0.45679	0.70000	0.88346	0.91732	0.94628
2	M	1255	0.20988	0.41600	0.48120	0.61811	0.72727
3	M	1255	0.21811	0.24400	0.43985	0.54331	0.78099
4	M	1255	0.57202	0.79600	0.85338	0.88189	0.90909
5	M	1255	0.13992	0.42000	0.62782	0.79134	0.90496
6	M	1255	0.25926	0.32400	0.45113	0.53937	0.78512
7	M	1255	0.66667	0.89200	0.95865	0.98031	0.99587
8	M	1255	0.39918	0.63200	0.80451	0.77953	0.90496
9	M	1255	0.18519	0.13200	0.19925	0.42913	0.80579
10	M	1255	0.24691	0.57600	0.82331	0.89764	0.97107
11	M	1255	0.24280	0.47200	0.65414	0.80709	0.92562
12	M	1255	0.23457	0.59200	0.81955	0.93701	0.99174
13	M	1255	0.20576	0.14800	0.16165	0.22835	0.34711
14	M	1255	0.24280	0.25200	0.42481	0.57874	0.77686
15	M	1255	0.36626	0.55600	0.64286	0.71654	0.92562
16	M	1255	0.20576	0.42800	0.70677	0.86614	0.97107
17	M	1255	0.47325	0.76000	0.86090	0.94882	0.98347
18	M	1255	0.26749	0.56400	0.75940	0.90157	0.96694
19	M	1255	0.28807	0.42800	0.53759	0.67323	0.75620
20	M	1255	0.26749	0.39200	0.57143	0.77559	0.85537
21	O	1255	0.11523	0.45600	0.95489	1.44094	1.78512
22	O	1255	0.10288	0.30400	1.26316	2.36220	3.34298
23	O	1255	0.01646	0.10800	0.07519	0.44094	3.05785
24	O	1255	0.35802	0.55600	0.82331	1.50000	2.22314
25	O	1255	0.07407	0.51200	1.06767	1.71654	2.30579
26	O	1255	0.13992	0.30400	0.45489	0.89370	1.79752
27	M	1255	0.54733	0.83200	0.94737	0.98425	1.00000
28	M	1255	0.38683	0.74000	0.85338	0.91732	0.95455
29	M	1255	0.23457	0.28400	0.43609	0.68898	0.87190
30	M	1255	0.22222	0.28800	0.35714	0.58661	0.79339
31	M	1255	0.46502	0.72800	0.83459	0.94094	0.97934
32	M	1255	0.27984	0.34400	0.51880	0.59449	0.83058
33	M	1255	0.13992	0.18800	0.20677	0.26772	0.50000
34	M	1255	0.19753	0.24000	0.35338	0.53150	0.82231
35	M	1255	0.44444	0.86800	0.95113	0.96457	0.99174
36	M	1255	0.34979	0.50400	0.72932	0.84646	0.92975
37	M	1255	0.25926	0.44800	0.67293	0.84646	0.94628
38	M	1255	0.17284	0.25600	0.45489	0.65748	0.84298
39	M	1255	0.43210	0.65600	0.73308	0.79921	0.93388
40	M	1255	0.31687	0.39200	0.55263	0.66535	0.83471
41	M	1255	0.28807	0.58800	0.74060	0.85433	0.93388
42	M	1255	0.27160	0.40400	0.63158	0.79134	0.94628
43	M	1255	0.44856	0.65200	0.78947	0.93307	0.98760
44	M	1255	0.28807	0.40400	0.51128	0.58661	0.74380
45	M	1255	0.20165	0.22800	0.32331	0.48425	0.72727
46	M	1255	0.29218	0.35200	0.44361	0.62598	0.81818

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 5 ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1255	0.40451	-0.29176	-0.21162	-0.17122	0.40451
2	M	1255	0.35876	0.35876	-0.16415	-0.21531	-0.06468
3	M	1255	0.41145	-0.21417	-0.16777	0.41145	-0.18710
4	M	1255	0.28189	0.28189	-0.20704	-0.08620	-0.23882
5	M	1255	0.53802	-0.35341	-0.14470	-0.25589	0.53802
6	M	1255	0.37446	-0.03965	0.37446	-0.23274	-0.29180
7	M	1255	0.36302	-0.17966	-0.19755	-0.23055	0.36302
8	M	1255	0.35624	-0.09009	0.35624	-0.26407	-0.22639
9	M	1255	0.47567	-0.20536	-0.27840	0.47567	-0.19884
10	M	1255	0.53488	0.53488	-0.27697	-0.32551	-0.22009
11	M	1255	0.49156	-0.17451	-0.28711	-0.29078	0.49156
12	M	1255	0.57192	-0.33062	-0.29936	-0.24175	0.57192
13	M	1255	0.15201	-0.18320	0.08549	0.15201	-0.08625
14	M	1255	0.40816	0.40816	-0.13172	-0.33666	-0.02626
15	M	1255	0.38858	-0.15748	0.38858	-0.17534	-0.25116
16	M	1255	0.56553	-0.20560	-0.36631	-0.29548	0.56553
17	M	1255	0.42862	-0.25064	-0.22115	-0.21485	0.42862
18	M	1255	0.52067	-0.27720	-0.30163	-0.23240	0.52067
19	M	1255	0.33552	-0.24815	0.33552	-0.19700	-0.13454
20	M	1255	0.45324	-0.23661	-0.29910	0.45324	-0.14665
21	O	1255	0.66548				
22	O	1255	0.74837				
23	O	1255	0.64112				
24	O	1255	0.63818				
25	O	1255	0.69281				
26	O	1255	0.55745				
27	M	1255	0.42940	-0.21466	0.42940	-0.26908	-0.21668
28	M	1255	0.43313	-0.19923	-0.29810	-0.20890	0.43313
29	M	1255	0.48158	-0.19211	-0.37052	0.48158	-0.12918
30	M	1255	0.41096	-0.19013	0.41096	-0.19170	-0.20882
31	M	1255	0.43086	-0.22746	-0.27367	-0.19544	0.43086
32	M	1255	0.38922	-0.11618	-0.17047	0.38922	-0.24387
33	M	1255	0.27900	-0.27154	0.01963	0.27900	-0.12645
34	M	1255	0.44696	-0.20148	0.44696	-0.26488	-0.21447
35	M	1255	0.44971	0.44971	-0.20839	-0.28327	-0.24146
36	M	1255	0.44517	-0.16156	0.44517	-0.33659	-0.16017
37	M	1255	0.51326	-0.23353	-0.32044	0.51326	-0.21352
38	M	1255	0.48355	0.48355	-0.12745	-0.30723	-0.19735
39	M	1255	0.36546	-0.22575	-0.18943	0.36546	-0.15648
40	M	1255	0.37900	-0.14344	-0.23156	0.37900	-0.19544
41	M	1255	0.46663	-0.24318	-0.25838	-0.24741	0.46663
42	M	1255	0.50543	0.50543	-0.25791	-0.33247	-0.12337
43	M	1255	0.45037	-0.25614	0.45037	-0.26012	-0.18135
44	M	1255	0.32010	-0.21536	-0.14723	-0.08112	0.32010
45	M	1255	0.39983	-0.14683	-0.21756	0.39983	-0.13445
46	M	1255	0.38062	0.38062	-0.18004	-0.17734	-0.16432

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 6 ITEM	TYPE	N	P_VAL	RAW MEAN	STDV
1	M	1217	0.68694	0.68694	0.46393
2	M	1217	0.81265	0.81265	0.39035
3	M	1217	0.85785	0.85785	0.34935
4	M	1217	0.88743	0.88743	0.31620
5	M	1217	0.88661	0.88661	0.31720
6	M	1217	0.75514	0.75514	0.43018
7	M	1217	0.87921	0.87921	0.32602
8	M	1217	0.63599	0.63599	0.48135
9	M	1217	0.55629	0.55629	0.49703
10	M	1217	0.13804	0.13804	0.34509
11	M	1217	0.75760	0.75760	0.42871
12	M	1217	0.61298	0.61298	0.48727
13	M	1217	0.56450	0.56450	0.49603
14	M	1217	0.62366	0.62366	0.48466
15	M	1217	0.90386	0.90386	0.29490
16	M	1217	0.36072	0.36072	0.48041
17	M	1217	0.67543	0.67543	0.46841
18	M	1217	0.68118	0.68118	0.46621
19	M	1217	0.46261	0.46261	0.49881
20	M	1217	0.54314	0.54314	0.49834
21	O	1217	0.41372	1.65489	1.62349
22	O	1217	0.31668	1.58340	1.40832
23	O	1217	0.28239	0.84717	1.21652
24	O	1217	0.33361	1.00082	1.16663
25	O	1217	0.20809	0.83237	1.50214
26	O	1217	0.36812	0.73624	0.87092
27	M	1217	0.74692	0.74692	0.43496
28	M	1217	0.46508	0.46508	0.49898
29	M	1217	0.68036	0.68036	0.46653
30	M	1217	0.40099	0.40099	0.49030
31	M	1217	0.44454	0.44454	0.49712
32	M	1217	0.52177	0.52177	0.49973
33	M	1217	0.52424	0.52424	0.49962
34	M	1217	0.57272	0.57272	0.49489
35	M	1217	0.70337	0.70337	0.45696
36	M	1217	0.72720	0.72720	0.44558
37	M	1217	0.41331	0.41331	0.49263
38	M	1217	0.52835	0.52835	0.49940
39	M	1217	0.54725	0.54725	0.49797
40	M	1217	0.63353	0.63353	0.48204
41	M	1217	0.58833	0.58833	0.49234
42	M	1217	0.70583	0.70583	0.45585
43	M	1217	0.49466	0.49466	0.50018
44	M	1217	0.31389	0.31389	0.46426
45	M	1217	0.79047	0.79047	0.40714
46	M	1217	0.44125	0.44125	0.49674

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 6 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN M3	QUIN_M4	QUIN_M5
1	M	1217	0.35622	0.59322	0.75746	0.79646	0.90551
2	M	1217	0.47639	0.78814	0.88806	0.92920	0.96063
3	M	1217	0.55794	0.79237	0.94030	0.97788	1.00000
4	M	1217	0.57511	0.93644	0.95896	0.98673	0.96457
5	M	1217	0.70815	0.88136	0.91045	0.94690	0.97638
6	M	1217	0.47210	0.67373	0.77612	0.88938	0.94882
7	M	1217	0.64378	0.86017	0.93284	0.95575	0.98819
8	M	1217	0.34764	0.51271	0.61940	0.78761	0.89764
9	M	1217	0.36481	0.39407	0.48134	0.65487	0.87402
10	M	1217	0.05579	0.10593	0.03731	0.11504	0.37008
11	M	1217	0.45923	0.66102	0.77612	0.91150	0.96457
12	M	1217	0.26609	0.34746	0.61567	0.86283	0.95276
13	M	1217	0.27039	0.38559	0.52985	0.71681	0.90157
14	M	1217	0.31330	0.43644	0.64925	0.79204	0.90551
15	M	1217	0.67382	0.88559	0.95149	0.99558	1.00000
16	M	1217	0.21459	0.29661	0.35075	0.37168	0.55512
17	M	1217	0.31760	0.47881	0.72015	0.88496	0.95276
18	M	1217	0.34335	0.55932	0.72388	0.85398	0.90551
19	M	1217	0.24893	0.35169	0.42910	0.51770	0.74803
20	M	1217	0.22747	0.41102	0.61567	0.64159	0.79134
21	O	1217	0.20172	0.87288	1.32463	2.50885	3.30315
22	O	1217	0.31330	0.88983	1.45149	2.03982	3.12598
23	O	1217	0.01717	0.18644	0.48507	1.19469	2.29528
24	O	1217	0.09871	0.26695	0.71642	1.55310	2.31890
25	O	1217	0.02146	0.06356	0.31716	1.14602	2.55512
26	O	1217	0.06438	0.23729	0.66418	0.97788	1.67717
27	M	1217	0.49356	0.68644	0.76493	0.86283	0.91339
28	M	1217	0.21459	0.30085	0.44776	0.57965	0.76378
29	M	1217	0.46781	0.55085	0.69030	0.78761	0.88976
30	M	1217	0.15021	0.31780	0.34701	0.47788	0.69685
31	M	1217	0.28326	0.41102	0.47388	0.55752	0.49213
32	M	1217	0.23176	0.28814	0.52612	0.69469	0.84646
33	M	1217	0.21459	0.35593	0.46642	0.69912	0.87008
34	M	1217	0.14592	0.30932	0.56716	0.83628	0.98031
35	M	1217	0.35622	0.56356	0.71642	0.88496	0.97638
36	M	1217	0.25322	0.58898	0.83582	0.93805	0.98819
37	M	1217	0.12876	0.18220	0.32463	0.52212	0.88583
38	M	1217	0.32189	0.40678	0.49254	0.57522	0.82677
39	M	1217	0.27468	0.34322	0.55224	0.71239	0.83465
40	M	1217	0.21030	0.44915	0.69403	0.84956	0.93701
41	M	1217	0.30901	0.41949	0.56343	0.71681	0.91339
42	M	1217	0.31330	0.56780	0.77239	0.87611	0.97244
43	M	1217	0.24034	0.30085	0.42910	0.68584	0.80709
44	M	1217	0.20601	0.21610	0.23507	0.32301	0.57874
45	M	1217	0.45923	0.69915	0.86194	0.93363	0.97638
46	M	1217	0.21459	0.33898	0.36567	0.49115	0.77953

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot Item Statistics by Form

FORM 6 ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1217	0.39511	0.39511	-0.18099	-0.20829	-0.21275
2	M	1217	0.39045	-0.25664	0.39045	-0.18426	-0.20788
3	M	1217	0.42747	-0.25664	0.42747	-0.27823	-0.15858
4	M	1217	0.35839	-0.20698	-0.24160	0.35839	-0.12938
5	M	1217	0.26084	0.26084	-0.16216	-0.14563	-0.14789
6	M	1217	0.38123	-0.19855	0.38123	-0.23223	-0.17137
7	M	1217	0.32808	0.32808	-0.18541	-0.22624	-0.11528
8	M	1217	0.40896	-0.21053	-0.18769	-0.22117	0.40896
9	M	1217	0.38877	-0.24244	0.38877	-0.17695	-0.11666
10	M	1217	0.31460	-0.12529	-0.08992	-0.02277	0.31460
11	M	1217	0.41822	-0.28441	-0.19361	0.41822	-0.18448
12	M	1217	0.54432	-0.20595	-0.35961	-0.23931	0.54432
13	M	1217	0.45605	-0.23288	-0.23077	0.45605	-0.17212
14	M	1217	0.45072	-0.19671	0.45072	-0.19774	-0.27604
15	M	1217	0.36478	-0.18391	-0.24376	0.36478	-0.17218
16	M	1217	0.25269	0.25269	-0.12472	-0.03195	-0.14623
17	M	1217	0.50260	-0.25385	0.50260	-0.30684	-0.19065
18	M	1217	0.41895	-0.08749	-0.35634	0.41895	-0.13557
19	M	1217	0.34953	-0.14413	0.34953	-0.15426	-0.16583
20	M	1217	0.38889	0.38889	-0.27143	-0.22059	-0.11240
21	O	1217	0.70400				
22	O	1217	0.70693				
23	O	1217	0.67978				
24	O	1217	0.71980				
25	O	1217	0.62208				
26	O	1217	0.66538				
27	M	1217	0.32850	-0.14701	0.32850	-0.19526	-0.17562
28	M	1217	0.40345	-0.15099	-0.36308	0.40345	0.05874
29	M	1217	0.34527	-0.22266	-0.16104	0.34527	-0.16960
30	M	1217	0.37516	0.37516	-0.25660	-0.10282	-0.09792
31	M	1217	0.16544	-0.20776	0.16544	0.09816	-0.14961
32	M	1217	0.47171	-0.19237	-0.21531	-0.24487	0.47171
33	M	1217	0.47650	-0.23702	0.47650	-0.26036	-0.16532
34	M	1217	0.62652	-0.24348	-0.33329	-0.30972	0.62652
35	M	1217	0.47713	-0.21862	-0.27485	0.47713	-0.23830
36	M	1217	0.55967	-0.25168	-0.32945	-0.28278	0.55967
37	M	1217	0.55336	-0.14400	-0.27866	-0.26760	0.55336
38	M	1217	0.36704	-0.18189	0.36704	-0.20928	-0.11853
39	M	1217	0.42359	-0.16901	0.42359	-0.21893	-0.19436
40	M	1217	0.53459	-0.23972	-0.25218	-0.29393	0.53459
41	M	1217	0.44797	-0.11953	-0.24943	0.44797	-0.28051
42	M	1217	0.50213	0.50213	-0.31419	-0.20917	-0.24461
43	M	1217	0.44590	-0.15336	0.44590	-0.21725	-0.21028
44	M	1217	0.29053	0.29053	-0.22038	-0.10388	0.03915
45	M	1217	0.43624	-0.22975	-0.20687	-0.24764	0.43624
46	M	1217	0.39020	-0.14269	-0.19682	0.39020	-0.14925

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 7 ITEM	TYPE	N	P VAL	RAW MEAN	STDV
1	M	1213	0.89777	0.89777	0.30307
2	M	1213	0.88458	0.88458	0.31966
3	M	1213	0.70404	0.70404	0.45666
4	M	1213	0.51772	0.51772	0.49989
5	M	1213	0.60429	0.60429	0.48921
6	M	1213	0.63232	0.63232	0.48237
7	M	1213	0.59522	0.59522	0.49105
8	M	1213	0.25309	0.25309	0.43496
9	M	1213	0.69827	0.69827	0.45920
10	M	1213	0.69744	0.69744	0.45955
11	M	1213	0.54823	0.54823	0.49787
12	M	1213	0.58450	0.58450	0.49301
13	M	1213	0.86232	0.86232	0.34470
14	M	1213	0.47568	0.47568	0.49961
15	M	1213	0.29761	0.29761	0.45740
16	M	1213	0.53751	0.53751	0.49880
17	M	1213	0.68838	0.68838	0.46335
18	M	1213	0.70734	0.70734	0.45517
19	M	1213	0.53998	0.53998	0.49860
20	M	1213	0.50866	0.50866	0.50013
21	O	1213	0.80791	1.61583	0.68396
22	O	1213	0.22407	1.12036	1.44207
23	O	1213	0.19071	0.57214	0.84380
24	O	1213	0.51580	1.54740	1.36750
25	O	1213	0.10697	0.42786	0.96769
26	O	1213	0.59089	2.36356	1.62709
27	M	1213	0.78236	0.78236	0.41281
28	M	1213	0.69085	0.69085	0.46233
29	M	1213	0.40973	0.40973	0.49199
30	M	1213	0.37181	0.37181	0.48349
31	M	1213	0.73702	0.73702	0.44044
32	M	1213	0.78813	0.78813	0.40880
33	M	1213	0.28937	0.28937	0.45365
34	M	1213	0.62572	0.62572	0.48414
35	M	1213	0.71970	0.71970	0.44933
36	M	1213	0.42127	0.42127	0.49397
37	M	1213	0.51443	0.51443	0.50000
38	M	1213	0.77824	0.77824	0.41560
39	M	1213	0.67601	0.67601	0.46819
40	M	1213	0.52679	0.52679	0.49949
41	M	1213	0.60841	0.60841	0.48831
42	M	1213	0.78483	0.78483	0.41111
43	M	1213	0.71641	0.71641	0.45093
44	M	1213	0.58203	0.58203	0.49343
45	M	1213	0.55647	0.55647	0.49701
46	M	1213	0.53833	0.53833	0.49873

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 7 ITEM	TYPE	N	QUIN_ M1	QUIN_ M2	QUIN_ M3	QUIN_M4	QUIN_ M5
1	M	1213	0.72961	0.88281	0.91250	0.97571	0.98312
2	M	1213	0.61373	0.85156	0.96667	0.98381	1.00000
3	M	1213	0.37768	0.57813	0.78750	0.82186	0.95359
4	M	1213	0.20172	0.30469	0.44167	0.73684	0.90717
5	M	1213	0.34335	0.55859	0.58750	0.67611	0.85232
6	M	1213	0.31760	0.56641	0.63750	0.71255	0.92405
7	M	1213	0.30472	0.42969	0.62083	0.74089	0.88186
8	M	1213	0.20172	0.22656	0.18750	0.17409	0.48101
9	M	1213	0.35622	0.57422	0.77500	0.81781	0.96624
10	M	1213	0.37339	0.54297	0.69583	0.91093	0.96203
11	M	1213	0.30901	0.48047	0.54167	0.58300	0.82700
12	M	1213	0.37768	0.42578	0.51667	0.72470	0.88186
13	M	1213	0.64807	0.83984	0.90417	0.92308	0.99156
14	M	1213	0.21888	0.23828	0.35833	0.67611	0.89451
15	M	1213	0.16738	0.19922	0.20000	0.29150	0.63713
16	M	1213	0.25322	0.41406	0.51667	0.66802	0.83544
17	M	1213	0.35193	0.57422	0.73333	0.83401	0.04515
18	M	1213	0.27468	0.58594	0.76250	0.92308	0.98312
19	M	1213	0.20172	0.37500	0.57500	0.69231	0.85654
20	M	1213	0.23605	0.43750	0.44583	0.60324	0.81857
21	O	1213	0.87983	1.58594	1.80000	1.85830	1.93249
22	O	1213	0.18455	0.52344	0.81250	1.20648	2.90717
23	O	1213	0.07296	0.19531	0.36250	0.69636	1.55274
24	O	1213	0.21030	0.69531	1.53750	2.42510	2.87764
25	O	1213	0.02575	0.10938	0.14583	0.52227	1.35443
26	O	1213	0.45923	1.65625	2.77083	3.17004	3.74684
27	M	1213	0.46781	0.69922	0.82083	0.92713	0.99156
28	M	1213	0.26180	0.48438	0.81250	0.93117	0.96203
29	M	1213	0.17597	0.35938	0.41250	0.49798	0.59916
30	M	1213	0.20172	0.18359	0.29583	0.48583	0.70042
31	M	1213	0.36481	0.63281	0.78750	0.91093	0.98312
32	M	1213	0.46352	0.71094	0.85417	0.95547	0.94937
33	M	1213	0.16738	0.15625	0.22917	0.32794	0.57384
34	M	1213	0.38627	0.61719	0.63333	0.68826	0.79747
35	M	1213	0.36910	0.55469	0.78333	0.91498	0.97468
36	M	1213	0.21459	0.20313	0.27500	0.55870	0.86498
37	M	1213	0.28326	0.30859	0.46667	0.64372	0.87764
38	M	1213	0.35622	0.69141	0.87500	0.96761	0.99156
39	M	1213	0.31760	0.49219	0.70000	0.91498	0.95359
40	M	1213	0.26609	0.35938	0.50833	0.67206	0.83122
41	M	1213	0.27468	0.48047	0.58750	0.80162	0.89451
42	M	1213	0.42918	0.72266	0.86250	0.91093	0.99156
43	M	1213	0.36052	0.62891	0.78750	0.85830	0.94093
44	M	1213	0.31330	0.48828	0.55417	0.68421	0.86920
45	M	1213	0.24893	0.33984	0.49167	0.76113	0.94515
46	M	1213	0.23605	0.37500	0.56667	0.70445	0.81013

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 7

ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1213	0.29758	-0.16678	-0.17382	0.29758	-0.15525
2	M	1213	0.40925	0.40925	-0.27373	-0.23812	-0.16054
3	M	1213	0.43170	-0.21526	-0.23789	0.43170	-0.22677
4	M	1213	0.51744	-0.13819	-0.35224	-0.20611	0.51744
5	M	1213	0.34342	-0.17111	0.34342	-0.23270	-0.14399
6	M	1213	0.41093	-0.14222	-0.20122	0.41093	-0.24825
7	M	1213	0.42253	-0.18106	0.42253	-0.18961	-0.24983
8	M	1213	0.19413	-0.23255	0.19413	-0.15411	0.10167
9	M	1213	0.44330	-0.17940	-0.23686	0.44330	-0.25536
10	M	1213	0.47635	-0.22215	-0.26476	0.47635	-0.23892
11	M	1213	0.34301	-0.04353	0.34301	-0.17598	-0.25346
12	M	1213	0.37519	0.37519	-0.24423	-0.22849	-0.06238
13	M	1213	0.32930	-0.19659	0.32930	-0.20450	-0.13199
14	M	1213	0.50961	-0.10988	-0.37312	0.50961	-0.15612
15	M	1213	0.34824	-0.11588	0.34824	-0.16316	-0.12933
16	M	1213	0.41177	-0.26182	0.41177	-0.16501	-0.22428
17	M	1213	0.44648	-0.22866	-0.23867	-0.22740	0.44648
18	M	1213	0.53946	-0.21857	0.53946	-0.27217	-0.32370
19	M	1213	0.46806	-0.23559	-0.26588	-0.24162	0.46806
20	M	1213	0.38120	-0.18598	-0.14081	-0.20675	0.38120
21	O	1213	0.50590				
22	O	1213	0.63837				
23	O	1213	0.61872				
24	O	1213	0.72318				
25	O	1213	0.50463				
26	O	1213	0.70649				
27	M	1213	0.44955	0.44955	-0.28181	-0.27337	-0.16804
28	M	1213	0.55816	-0.36742	0.55816	-0.28631	-0.17887
29	M	1213	0.28912	0.28912	-0.11663	-0.17970	-0.05735
30	M	1213	0.39223	-0.05672	0.39223	-0.27214	-0.16130
31	M	1213	0.49012	-0.27685	0.49012	-0.28211	-0.20086
32	M	1213	0.43362	0.43362	-0.33008	-0.14562	-0.18388
33	M	1213	0.32980	-0.22973	0.32980	-0.04435	-0.24952
34	M	1213	0.28795	-0.24186	-0.19436	0.28795	-0.03610
35	M	1213	0.49442	-0.26039	-0.24181	-0.24832	0.49442
36	M	1213	0.47780	-0.14574	0.47780	-0.26344	-0.19052
37	M	1213	0.43417	-0.23592	-0.36269	0.43417	-0.04378
38	M	1213	0.52575	-0.29201	-0.27214	-0.27517	0.52575
39	M	1213	0.51565	-0.18925	-0.30406	-0.27429	0.51565
40	M	1213	0.40917	-0.24918	0.40917	-0.10252	-0.22968
41	M	1213	0.45274	0.45274	-0.16118	-0.24770	-0.24862
42	M	1213	0.45158	-0.20787	-0.30290	-0.19599	0.45158
43	M	1213	0.43644	0.43644	-0.26100	-0.24139	-0.16219
44	M	1213	0.37912	-0.22667	-0.23511	0.37912	-0.07719
45	M	1213	0.51881	-0.18764	0.51881	-0.30494	-0.21329
46	M	1213	0.42578	0.42578	-0.18056	-0.22227	-0.21738

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 8 ITEM	TYPE	N	P VAL	RAW MEAN	STDV
1	M	1383	0.63268	0.63268	0.48225
2	M	1383	0.66161	0.66161	0.47333
3	M	1383	0.75343	0.75343	0.43117
4	M	1383	0.61171	0.61171	0.48754
5	M	1383	0.87780	0.87780	0.32763
6	M	1383	0.91106	0.91106	0.28476
7	M	1383	0.61894	0.61894	0.48582
8	M	1383	0.65148	0.65148	0.47667
9	M	1383	0.68113	0.68113	0.46621
10	M	1383	0.73970	0.73970	0.43896
11	M	1383	0.77368	0.77368	0.41860
12	M	1383	0.29573	0.29573	0.45654
13	M	1383	0.80043	0.80043	0.39982
14	M	1383	0.56688	0.56688	0.49569
15	M	1383	0.55242	0.55242	0.49742
16	M	1383	0.32755	0.32755	0.46949
17	M	1383	0.64064	0.64064	0.47999
18	M	1383	0.56544	0.56544	0.49588
19	M	1383	0.30152	0.30152	0.45908
20	M	1383	0.76139	0.76139	0.42639
21	O	1383	0.38901	0.77802	0.81273
22	O	1383	0.54953	2.19812	1.79598
23	O	1383	0.28055	0.84165	1.13245
24	O	1383	0.38482	1.92408	1.51381
25	O	1383	0.42697	1.70788	1.74702
26	O	1383	0.53868	1.61605	1.39025
27	M	1383	0.76356	0.76356	0.42505
28	M	1383	0.53796	0.53796	0.49874
29	M	1383	0.53435	0.53435	0.49900
30	M	1383	0.79899	0.79899	0.40090
31	M	1383	0.43818	0.43818	0.49634
32	M	1383	0.70499	0.70499	0.45621
33	M	1383	0.34273	0.34273	0.47479
34	M	1383	0.34490	0.34490	0.47551
35	M	1383	0.43022	0.43022	0.49529
36	M	1383	0.60448	0.60448	0.48914
37	M	1383	0.27260	0.27260	0.44546
38	M	1383	0.39841	0.39841	0.48975
39	M	1383	0.44613	0.44613	0.49727
40	M	1383	0.76862	0.76862	0.42187
41	M	1383	0.43239	0.43239	0.49559
42	M	1383	0.71728	0.71728	0.45048
43	M	1383	0.42661	0.42661	0.49476
44	M	1383	0.44613	0.44613	0.49727
45	M	1383	0.54375	0.54375	0.49826
46	M	1383	0.49096	0.49096	0.50010

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 8 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN_M3	QUIN_M4	QUIN_M5
1	M	1383	0.32364	0.53008	0.61348	0.77931	0.91111
2	M	1383	0.32000	0.56767	0.67730	0.82414	0.91111
3	M	1383	0.55273	0.72932	0.74823	0.85517	0.87778
4	M	1383	0.31636	0.38722	0.59574	0.80345	0.94444
5	M	1383	0.63273	0.86466	0.94681	0.95172	0.98889
6	M	1383	0.74545	0.89098	0.96099	0.96897	0.98519
7	M	1383	0.31273	0.50376	0.63121	0.73793	0.90370
8	M	1383	0.34182	0.46617	0.63830	0.84138	0.95926
9	M	1383	0.38182	0.53759	0.70922	0.83793	0.92963
10	M	1383	0.42909	0.60902	0.80496	0.91034	0.93333
11	M	1383	0.41091	0.69549	0.81915	0.95172	0.98148
12	M	1383	0.19273	0.28947	0.26241	0.28621	0.45185
13	M	1383	0.49818	0.70301	0.84043	0.95862	0.99259
14	M	1383	0.28364	0.47744	0.58865	0.67931	0.80000
15	M	1383	0.40364	0.48872	0.52482	0.57931	0.76667
16	M	1383	0.28000	0.27068	0.25177	0.34828	0.48889
17	M	1383	0.37455	0.50376	0.63830	0.76897	0.91111
18	M	1383	0.28727	0.36842	0.55674	0.74138	0.86296
19	M	1383	0.21091	0.20301	0.20922	0.30690	0.58148
20	M	1383	0.40727	0.71805	0.80142	0.89310	0.98148
21	O	1383	0.08727	0.31955	0.64184	1.14828	1.67778
22	O	1383	0.32000	1.19173	2.24823	3.34483	3.81852
23	O	1383	0.05455	0.16917	0.53546	1.14828	2.29630
24	O	1383	0.37091	1.30075	1.96099	2.53103	3.42963
25	O	1383	0.05455	0.48120	1.50355	2.77931	3.66296
26	O	1383	0.20000	0.78195	1.68085	2.50345	2.85926
27	M	1383	0.54545	0.69549	0.78723	0.88966	0.89259
28	M	1383	0.19273	0.31203	0.54610	0.76897	0.85556
29	M	1383	0.32364	0.41353	0.57447	0.65172	0.70000
30	M	1383	0.46909	0.69925	0.86525	0.95862	0.99259
31	M	1383	0.22182	0.29323	0.35461	0.54138	0.77778
32	M	1383	0.35636	0.54511	0.73050	0.92069	0.95926
33	M	1383	0.19273	0.22556	0.26596	0.35172	0.68148
34	M	1383	0.13455	0.22180	0.27305	0.38276	0.71481
35	M	1383	0.13818	0.13534	0.29787	0.64138	0.92963
36	M	1383	0.27273	0.36466	0.62766	0.80690	0.93704
37	M	1383	0.16000	0.13910	0.09929	0.27586	0.69630
38	M	1383	0.27636	0.33835	0.34043	0.38966	0.65185
39	M	1383	0.14182	0.20677	0.40780	0.60690	0.85926
40	M	1383	0.37818	0.60526	0.86879	0.97586	1.00000
41	M	1383	0.16000	0.14662	0.35461	0.60690	0.88519
42	M	1383	0.41455	0.57519	0.77660	0.88621	0.92222
43	M	1383	0.22909	0.31203	0.34043	0.51034	0.74074
44	M	1383	0.13455	0.19173	0.38652	0.64483	0.86296
45	M	1383	0.33818	0.40977	0.50000	0.60000	0.87037
46	M	1383	0.22545	0.27444	0.35106	0.67241	0.92593

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 8 ITEM	TYPE	N	R_ ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1383	0.42548	-0.12803	-0.26950	-0.22168	0.42548
2	M	1383	0.43244	-0.16605	-0.12647	-0.33973	0.43244
3	M	1383	0.26149	-0.20773	-0.05454	0.26149	-0.18843
4	M	1383	0.49431	-0.11856	-0.26599	-0.30718	0.49431
5	M	1383	0.35457	0.35457	-0.23098	-0.15820	-0.19399
6	M	1383	0.29243	-0.15013	0.29243	-0.18347	-0.16267
7	M	1383	0.40933	-0.25503	0.40933	-0.15520	-0.18994
8	M	1383	0.49183	-0.22378	-0.32111	0.49183	-0.18661
9	M	1383	0.42948	-0.26025	0.42948	-0.25591	-0.18591
10	M	1383	0.42867	-0.23846	-0.22977	0.42867	-0.19626
11	M	1383	0.47656	-0.25219	-0.24155	-0.26007	0.47656
12	M	1383	0.17027	0.17027	-0.20687	-0.12935	0.10359
13	M	1383	0.44474	0.44474	-0.25869	-0.25922	-0.18674
14	M	1383	0.36456	-0.08720	-0.27611	0.36456	-0.21338
15	M	1383	0.25241	-0.18630	0.25241	-0.00942	-0.23883
16	M	1383	0.16993	-0.14298	0.16993	-0.18785	0.10413
17	M	1383	0.40350	-0.20138	-0.16214	-0.24279	0.40350
18	M	1383	0.43958	-0.28178	0.43958	-0.18870	-0.22553
19	M	1383	0.28690	0.03753	-0.26120	0.28690	-0.18545
20	M	1383	0.44440	0.44440	-0.21601	-0.31191	-0.18912
21	O	1383	0.71227				
22	O	1383	0.72256				
23	O	1383	0.69970				
24	O	1383	0.70710				
25	O	1383	0.78204				
26	O	1383	0.72388				
27	M	1383	0.30928	-0.20893	-0.21477	0.30928	-0.05745
28	M	1383	0.51195	-0.21411	-0.32356	-0.20199	0.51195
29	M	1383	0.28670	-0.05078	-0.03669	-0.25876	0.28670
30	M	1383	0.46669	-0.21223	0.46669	-0.29757	-0.23359
31	M	1383	0.40082	0.40082	-0.29174	-0.14697	-0.08467
32	M	1383	0.49842	0.49842	-0.30059	-0.23234	-0.23487
33	M	1383	0.34545	-0.00917	-0.20600	0.34545	-0.17444
34	M	1383	0.40027	-0.24535	-0.10546	-0.17095	0.40027
35	M	1383	0.59905	0.59905	-0.32398	-0.26257	-0.17927
36	M	1383	0.51891	-0.18384	0.51891	-0.26584	-0.30129
37	M	1383	0.40939	-0.27095	0.40939	-0.16915	-0.01360
38	M	1383	0.23637	-0.12548	-0.18479	0.23637	0.05354
39	M	1383	0.52961	-0.08737	-0.29471	-0.28879	0.52961
40	M	1383	0.53503	-0.26729	0.53503	-0.35603	-0.19898
41	M	1383	0.55323	0.55323	-0.24115	-0.21107	-0.26496
42	M	1383	0.41914	-0.20893	-0.23539	0.41914	-0.21130
43	M	1383	0.36165	-0.10816	-0.12484	0.36165	-0.20865
44	M	1383	0.55504	-0.34428	-0.19655	-0.15360	0.55504
45	M	1383	0.36506	-0.16615	-0.19455	0.36506	-0.13340
46	M	1383	0.52434	0.52434	-0.24181	-0.22911	-0.24621

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 9

ITEM	TYPE	N	P_VAL	RAW MEAN	STDV
1	M	1404	0.77920	0.77920	0.41493
2	M	1404	0.75214	0.75214	0.43193
3	M	1404	0.41239	0.41239	0.49244
4	M	1404	0.73148	0.73148	0.44335
5	M	1404	0.76353	0.76353	0.42506
6	M	1404	0.71724	0.71724	0.45050
7	M	1404	0.72863	0.72863	0.44482
8	M	1404	0.43946	0.43946	0.49650
9	M	1404	0.48148	0.48148	0.49983
10	M	1404	0.16026	0.16026	0.36697
11	M	1404	0.68946	0.68946	0.46288
12	M	1404	0.64459	0.64459	0.47881
13	M	1404	0.66667	0.66667	0.47157
14	M	1404	0.52778	0.52778	0.49941
15	M	1404	0.39174	0.39174	0.48831
16	M	1404	0.73291	0.73291	0.44260
17	M	1404	0.65313	0.65313	0.47614
18	M	1404	0.77849	0.77849	0.41541
19	M	1404	0.78632	0.78632	0.41005
20	M	1404	0.73148	0.73148	0.44335
21	O	1404	0.73860	1.47721	0.79748
22	O	1404	0.30235	1.20940	1.26331
23	O	1404	0.21795	1.08974	1.44283
24	O	1404	0.36301	1.08903	1.19630
25	O	1404	0.46059	1.38177	1.33311
26	O	1404	0.26425	1.05698	1.37730
27	M	1404	0.64530	0.64530	0.47859
28	M	1404	0.87322	0.87322	0.33285
29	M	1404	0.54202	0.54202	0.49841
30	M	1404	0.85043	0.85043	0.35678
31	M	1404	0.76140	0.76140	0.42638
32	M	1404	0.38889	0.38889	0.48767
33	M	1404	0.54345	0.54345	0.49829
34	M	1404	0.72792	0.72792	0.44519
35	M	1404	0.49786	0.49786	0.50017
36	M	1404	0.52707	0.52707	0.49944
37	M	1404	0.76781	0.76781	0.42238
38	M	1404	0.40313	0.40313	0.49070
39	M	1404	0.47151	0.47151	0.49937
40	M	1404	0.69373	0.69373	0.46111
41	M	1404	0.32692	0.32692	0.46926
42	M	1404	0.66026	0.66026	0.47379
43	M	1404	0.45370	0.45370	0.49803
44	M	1404	0.71011	0.71011	0.45387
45	M	1404	0.65812	0.65812	0.47451
46	M	1404	0.58618	0.58618	0.49269

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 9 ITEM	TYPE	N	QUIN_MI	QUIN_M2	QUIN M3	QUIN_M4	QUIN_M5
1	M	1404	0.50562	0.70629	0.83099	0.88055	0.95985
2	M	1404	0.44569	0.66434	0.79930	0.86689	0.97080
3	M	1404	0.17603	0.26923	0.34155	0.48123	0.79197
4	M	1404	0.43446	0.60839	0.78521	0.87372	0.94161
5	M	1404	0.47191	0.64685	0.78873	0.91468	0.98175
6	M	1404	0.38577	0.60839	0.75704	0.88737	0.93066
7	M	1404	0.39326	0.63636	0.79930	0.86348	0.93431
8	M	1404	0.18727	0.29371	0.33099	0.54949	0.83212
9	M	1404	0.17978	0.29021	0.47887	0.63140	0.81752
10	M	1404	0.10487	0.09441	0.11972	0.12969	0.35766
11	M	1404	0.37453	0.55594	0.72535	0.83959	0.93796
12	M	1404	0.31835	0.48601	0.69014	0.78157	0.93431
13	M	1404	0.29963	0.53147	0.71831	0.82594	0.94161
14	M	1404	0.14607	0.34965	0.48944	0.70307	0.93796
15	M	1404	0.24345	0.23077	0.22183	0.45392	0.81387
16	M	1404	0.38951	0.62937	0.77113	0.88737	0.97080
17	M	1404	0.40824	0.49650	0.60211	0.81911	0.93066
18	M	1404	0.40824	0.69930	0.84507	0.93174	0.98905
19	M	1404	0.51311	0.72028	0.85915	0.88055	0.94526
20	M	1404	0.43820	0.67832	0.76408	0.88055	0.87956
21	O	1404	0.74532	1.34266	1.59155	1.75085	1.91971
22	O	1404	0.13109	0.54196	1.02465	1.75085	2.56934
23	O	1404	0.04494	0.24126	0.55282	1.56997	3.03650
24	O	1404	0.19850	0.52448	0.92958	1.45051	2.32482
25	O	1404	0.13109	0.51748	1.26408	2.09898	2.85766
26	O	1404	0.20225	0.52448	0.83451	1.23549	2.48540
27	M	1404	0.32584	0.50699	0.64789	0.82253	0.90876
28	M	1404	0.59925	0.86713	0.91901	0.97952	0.98540
29	M	1404	0.33708	0.48951	0.54930	0.62457	0.70073
30	M	1404	0.60674	0.83566	0.90493	0.92833	0.96350
31	M	1404	0.47940	0.61888	0.81338	0.89761	0.98540
32	M	1404	0.17978	0.17832	0.28521	0.49829	0.80292
33	M	1404	0.23970	0.27972	0.48592	0.75427	0.94891
34	M	1404	0.44195	0.63986	0.77113	0.81570	0.95985
35	M	1404	0.28464	0.39510	0.48944	0.57679	0.73723
36	M	1404	0.19101	0.34965	0.53873	0.70307	0.83942
37	M	1404	0.42322	0.67483	0.79930	0.93515	0.98905
38	M	1404	0.22097	0.25874	0.31338	0.50171	0.71898
39	M	1404	0.26966	0.36713	0.41901	0.50853	0.79197
40	M	1404	0.32584	0.56294	0.73239	0.86007	0.97080
41	M	1404	0.25094	0.23077	0.25000	0.32765	0.58029
42	M	1404	0.31086	0.56294	0.66549	0.78840	0.95985
43	M	1404	0.13483	0.22727	0.30986	0.64846	0.94161
44	M	1404	0.36704	0.59441	0.72183	0.87713	0.97445
45	M	1404	0.28090	0.51748	0.65493	0.84642	0.97445
46	M	1404	0.22846	0.49650	0.49648	0.76451	0.93066

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 9 ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1404	0.36904	0.36904	-0.28105	-0.16911	-0.11604
2	M	1404	0.41737	-0.21053	-0.21845	-0.26475	0.41737
3	M	1404	0.43221	-0.09733	0.43221	-0.30908	-0.10717
4	M	1404	0.40737	-0.14220	-0.27674	0.40737	-0.21061
5	M	1404	0.42101	-0.29552	0.42101	-0.21577	-0.15175
6	M	1404	0.43121	-0.24005	-0.23737	-0.21253	0.43121
7	M	1404	0.41512	-0.25034	-0.22745	0.41512	-0.19517
8	M	1404	0.43998	-0.11332	0.43998	-0.26924	-0.16949
9	M	1404	0.46132	0.46132	-0.25659	-0.21281	-0.13489
10	M	1404	0.23807	-0.03422	-0.14431	-0.00141	0.23807
11	M	1404	0.43143	-0.25987	0.43143	-0.20505	-0.19344
12	M	1404	0.44058	0.44058	-0.22369	-0.23429	-0.20006
13	M	1404	0.47331	0.47331	-0.23106	-0.30180	-0.17752
14	M	1404	0.55073	-0.28964	-0.23482	-0.22850	0.55073
15	M	1404	0.42027	-0.17185	0.42027	-0.18967	-0.17489
16	M	1404	0.46156	-0.26525	-0.22404	-0.23893	0.46156
17	M	1404	0.41800	-0.26068	0.41800	-0.21917	-0.16290
18	M	1404	0.47677	-0.24600	-0.26375	0.47677	-0.24769
19	M	1404	0.34640	-0.17321	-0.21077	-0.18991	0.34640
20	M	1404	0.34760	-0.32206	0.34760	-0.11770	-0.03586
21	O	1404	0.49205				
22	O	1404	0.69506				
23	O	1404	0.75143				
24	O	1404	0.62780				
25	O	1404	0.74227				
26	O	1404	0.56369				
27	M	1404	0.44773	0.44773	-0.22815	-0.23387	-0.21505
28	M	1404	0.37639	-0.17669	-0.27393	0.37639	-0.15056
29	M	1404	0.25182	-0.11810	0.25182	-0.17934	-0.05013
30	M	1404	0.31176	-0.16494	-0.17797	0.31176	-0.17408
31	M	1404	0.42855	-0.21214	0.42855	-0.23231	-0.24207
32	M	1404	0.47363	0.47363	-0.17249	-0.22724	-0.17184
33	M	1404	0.54030	0.54030	-0.30095	-0.24138	-0.22198
34	M	1404	0.38299	-0.22562	-0.24127	0.38299	-0.12437
35	M	1404	0.33250	-0.28504	-0.11292	-0.05502	0.33250
36	M	1404	0.47200	-0.29365	-0.24740	-0.11388	0.47200
37	M	1404	0.46122	-0.19067	0.46122	-0.34889	-0.15851
38	M	1404	0.36935	-0.22401	-0.21710	0.36935	-0.00090
39	M	1404	0.35704	0.35704	-0.11093	-0.24421	-0.20676
40	M	1404	0.48117	-0.22529	-0.27857	0.48117	-0.22514
41	M	1404	0.26571	-0.09575	-0.22606	0.26571	0.03226
42	M	1404	0.45689	-0.26544	-0.25886	0.45689	-0.15524
43	M	1404	0.58485	0.58485	-0.31558	-0.27606	-0.14296
44	M	1404	0.46336	-0.23516	-0.26861	0.46336	-0.20222
45	M	1404	0.50014	0.50014	-0.25477	-0.30361	-0.18912
46	M	1404	0.48467	-0.26491	-0.22207	-0.20016	0.48467

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 10 ITEM	TYPE	N	P VAL	RAW MEAN	STDV
1	M	1261	0.58208	0.58208	0.49341
2	M	1261	0.84298	0.84298	0.36396
3	M	1261	0.77240	0.77240	0.41945
4	M	1261	0.72958	0.72958	0.44435
5	M	1261	0.63045	0.63045	0.48287
6	M	1261	0.85488	0.85488	0.35236
7	M	1261	0.74227	0.74227	0.43756
8	M	1261	0.41316	0.41316	0.49260
9	M	1261	0.53053	0.53053	0.49926
10	M	1261	0.76685	0.76685	0.42300
11	M	1261	0.67803	0.67803	0.46742
12	M	1261	0.26408	0.26408	0.44101
13	M	1261	0.94132	0.94132	0.23512
14	M	1261	0.68596	0.68596	0.46432
15	M	1261	0.21253	0.21253	0.40926
16	M	1261	0.34893	0.34893	0.47682
17	M	1261	0.56067	0.56067	0.49650
18	M	1261	0.31007	0.31007	0.46271
19	M	1261	0.28549	0.28549	0.45183
20	M	1261	0.60270	0.60270	0.48953
21	O	1261	0.38647	1.15940	1.06717
22	O	1261	0.36023	1.44092	1.60526
23	O	1261	0.56126	2.24504	1.28461
24	O	1261	0.58763	1.17526	0.93870
25	O	1261	0.43267	2.16336	1.73899
26	O	1261	0.22495	0.67486	1.09352
27	M	1261	0.55670	0.55670	0.49697
28	M	1261	0.77478	0.77478	0.41789
29	M	1261	0.55274	0.55274	0.49741
30	M	1261	0.93497	0.93497	0.24667
31	M	1261	0.44171	0.44171	0.49679
32	M	1261	0.62649	0.62649	0.48393
33	M	1261	0.41554	0.41554	0.49301
34	M	1261	0.83743	0.83743	0.36912
35	M	1261	0.62411	0.62411	0.48454
36	M	1261	0.68914	0.68914	0.46303
37	M	1261	0.71610	0.71610	0.45107
38	M	1261	0.43537	0.43537	0.49600
39	M	1261	0.53291	0.53291	0.49911
40	M	1261	0.67645	0.67645	0.46802
41	M	1261	0.59794	0.59794	0.49051
42	M	1261	0.53370	0.53370	0.49906
43	M	1261	0.62331	0.62331	0.48475
44	M	1261	0.55353	0.55353	0.49732
45	M	1261	0.39492	0.39492	0.48903
46	M	1261	0.56305	0.56305	0.49621

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 10 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN_M3	QUIN_M4	QUIN_M5
1	M	1261	0.22984	0.42063	0.60806	0.74026	0.91051
2	M	1261	0.55242	0.84127	0.89744	0.93074	0.98833
3	M	1261	0.49194	0.71825	0.79121	0.90909	0.95331
4	M	1261	0.33871	0.64286	0.81685	0.89610	0.94942
5	M	1261	0.31048	0.53175	0.63736	0.77489	0.89883
6	M	1261	0.50806	0.82937	0.94139	0.99567	0.99611
7	M	1261	0.45565	0.66667	0.81685	0.84848	0.91829
8	M	1261	0.11694	0.15873	0.37729	0.59740	0.82101
9	M	1261	0.32258	0.46032	0.49084	0.61905	0.76265
10	M	1261	0.45565	0.69841	0.80220	0.90909	0.96887
11	M	1261	0.41935	0.59524	0.70330	0.76623	0.90272
12	M	1261	0.19758	0.21032	0.19048	0.27273	0.45136
13	M	1261	0.78629	0.95635	0.98535	0.98268	0.99222
14	M	1261	0.23387	0.54762	0.79853	0.87879	0.96498
15	M	1261	0.09677	0.05952	0.13187	0.22511	0.54864
16	M	1261	0.23387	0.26587	0.31136	0.35931	0.57198
17	M	1261	0.28226	0.37698	0.60806	0.67532	0.85603
18	M	1261	0.12903	0.15476	0.26007	0.35498	0.64981
19	M	1261	0.23790	0.17460	0.18681	0.27706	0.55253
20	M	1261	0.37903	0.44048	0.61905	0.73593	0.84047
21	O	1261	0.35887	0.91667	1.26007	1.35065	1.89105
22	O	1261	0.15726	0.45635	1.05495	1.98268	3.56809
23	O	1261	0.95968	1.86905	2.42857	2.70563	3.24514
24	O	1261	0.15323	0.71032	1.32234	1.74892	1.94553
25	O	1261	0.33468	1.22619	1.97802	3.21212	4.10117
26	O	1261	0.10887	0.10714	0.34432	0.83117	1.98833
27	M	1261	0.39919	0.55159	0.53846	0.64502	0.65370
28	M	1261	0.36290	0.69048	0.87179	0.95238	0.99222
29	M	1261	0.27016	0.37698	0.56410	0.67532	0.87549
30	M	1261	0.80645	0.92063	0.96703	0.98701	0.99222
31	M	1261	0.19758	0.28175	0.40659	0.55844	0.76654
32	M	1261	0.26210	0.50397	0.68498	0.77489	0.90272
33	M	1261	0.32661	0.28571	0.36630	0.45455	0.64591
34	M	1261	0.50403	0.82143	0.91575	0.96104	0.98054
35	M	1261	0.27823	0.57143	0.65934	0.74026	0.86770
36	M	1261	0.33065	0.51190	0.73626	0.91342	0.95720
37	M	1261	0.34677	0.57540	0.76557	0.91342	0.98054
38	M	1261	0.20161	0.34524	0.45788	0.52381	0.64591
39	M	1261	0.20161	0.29762	0.50183	0.71861	0.94942
40	M	1261	0.47581	0.58730	0.63736	0.81818	0.87160
41	M	1261	0.28629	0.43651	0.60806	0.76623	0.89494
42	M	1261	0.20565	0.37698	0.49084	0.71861	0.88327
43	M	1261	0.26210	0.39683	0.66300	0.84416	0.95331
44	M	1261	0.29435	0.39286	0.54212	0.64935	0.88716
45	M	1261	0.22581	0.27778	0.34066	0.44589	0.68482
46	M	1261	0.32258	0.44444	0.54212	0.65368	0.85214

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 10 ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1261	0.49286	-0.13322	0.49286	-0.43615	-0.03464
2	M	1261	0.39220	-0.22314	-0.22142	-0.19970	0.39220
3	M	1261	0.38580	0.38580	-0.23627	-0.16061	-0.22497
4	M	1261	0.47679	-0.20401	0.47679	-0.24475	-0.29679
5	M	1261	0.41871	-0.12256	0.41871	-0.28351	-0.20646
6	M	1261	0.48539	-0.20959	-0.32648	0.48539	-0.24495
7	M	1261	0.37483	-0.05199	-0.14839	0.37483	-0.33319
8	M	1261	0.53629	-0.29795	-0.26256	-0.13986	0.53629
9	M	1261	0.30423	-0.24594	-0.04415	0.30423	-0.15554
10	M	1261	0.43022	-0.20178	-0.27889	0.43022	-0.19663
11	M	1261	0.35556	-0.15617	-0.15327	-0.25794	0.35556
12	M	1261	0.21621	0.21621	0.04988	-0.19007	-0.10376
13	M	1261	0.28695	-0.15817	-0.20880	0.28695	-0.10577
14	M	1261	0.54471	0.54471	-0.39812	-0.24757	-0.15913
15	M	1261	0.39159	-0.24511	-0.01321	-0.17936	0.39159
16	M	1261	0.25171	0.25171	-0.14170	-0.05764	-0.21819
17	M	1261	0.41441	0.41441	-0.24453	-0.19795	-0.12930
18	M	1261	0.40432	-0.07386	-0.21423	-0.18933	0.40432
19	M	1261	0.25276	-0.04152	0.25276	-0.24379	-0.05524
20	M	1261	0.36094	-0.07437	0.36094	-0.22053	-0.24007
21	O	1261	0.48469				
22	O	1261	0.75261				
23	O	1261	0.62542				
24	O	1261	0.69431				
25	O	1261	0.77984				
26	O	1261	0.61896				
27	M	1261	0.18581	-0.14157	0.18581	-0.14207	0.03199
28	M	1261	0.51192	-0.26649	-0.32945	0.51192	-0.20686
29	M	1261	0.43117	-0.18041	0.43117	-0.11551	-0.29337
30	M	1261	0.27211	-0.12736	-0.19489	-0.13056	0.27211
31	M	1261	0.41714	0.41714	-0.19770	-0.20206	-0.17042
32	M	1261	0.46414	0.46414	-0.30581	-0.21224	-0.23148
33	M	1261	0.24765	-0.11909	-0.12185	0.24765	-0.07382
34	M	1261	0.43876	-0.23690	-0.28068	0.43876	-0.19422
35	M	1261	0.40723	-0.27601	0.40723	-0.15115	-0.20177
36	M	1261	0.50091	-0.30189	-0.29510	0.50091	-0.14907
37	M	1261	0.50423	-0.29014	-0.30791	0.50423	-0.16661
38	M	1261	0.31679	0.31679	-0.19248	-0.02442	-0.25142
39	M	1261	0.54690	-0.21416	-0.32965	0.54690	-0.20831
40	M	1261	0.31790	-0.13974	-0.20250	0.31790	-0.13782
41	M	1261	0.45298	-0.25419	-0.24069	0.45298	-0.17901
42	M	1261	0.47713	-0.21444	-0.31259	-0.12103	0.47713
43	M	1261	0.53644	0.53644	-0.27847	-0.27577	-0.24175
44	M	1261	0.41401	-0.21275	0.41401	-0.18027	-0.17819
45	M	1261	0.33347	-0.13229	-0.31458	0.33347	0.03390
46	M	1261	0.36874	-0.21711	-0.20630	0.36874	-0.08247

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 11 ITEM	TYPE	N	P_VAL	RAW MEAN	STDV
1	M	1105	0.72851	0.72851	0.44493
2	M	1105	0.89864	0.89864	0.30194
3	M	1105	0.83529	0.83529	0.37108
4	M	1105	0.67330	0.67330	0.46922
5	M	1105	0.80814	0.80814	0.39394
6	M	1105	0.86968	0.86968	0.33680
7	M	1105	0.79005	0.79005	0.40746
8	M	1105	0.57647	0.57647	0.49434
9	M	1105	0.26154	0.26154	0.43967
10	M	1105	0.69774	0.69774	0.45945
11	M	1105	0.49050	0.49050	0.50014
12	M	1105	0.74027	0.74027	0.43868
13	M	1105	0.66154	0.66154	0.47340
14	M	1105	0.57014	0.57014	0.49528
15	M	1105	0.26425	0.26425	0.44113
16	M	1105	0.60724	0.60724	0.48859
17	M	1105	0.68869	0.68869	0.46324
18	M	1105	0.49231	0.49231	0.50017
19	M	1105	0.47149	0.47149	0.49941
20	M	1105	0.61991	0.61991	0.48563
21	O	1105	0.29683	0.59367	0.72392
22	O	1105	0.77587	2.32760	1.00245
23	O	1105	0.11439	0.57195	1.17512
24	O	1105	0.29683	1.18733	1.19564
25	O	1105	0.38937	1.55747	1.60744
26	O	1105	0.34630	1.03891	1.27948
27	M	1105	0.64253	0.64253	0.47947
28	M	1105	0.64434	0.64434	0.47893
29	M	1105	0.85792	0.85792	0.34929
30	M	1105	0.48054	0.48054	0.49985
31	M	1105	0.78371	0.78371	0.41190
32	M	1105	0.51946	0.51946	0.49985
33	M	1105	0.47240	0.47240	0.49946
34	M	1105	0.50498	0.50498	0.50020
35	M	1105	0.72308	0.72308	0.44768
36	M	1105	0.65430	0.65430	0.47581
37	M	1105	0.65339	0.65339	0.47610
38	M	1105	0.28054	0.28054	0.44947
39	M	1105	0.71855	0.71855	0.44991
40	M	1105	0.81448	0.81448	0.38890
41	M	1105	0.58824	0.58824	0.49238
42	M	1105	0.56199	0.56199	0.49637
43	M	1105	0.57828	0.57828	0.49406
44	M	1105	0.78190	0.78190	0.41314
45	M	1105	0.47873	0.47873	0.49977
46	M	1105	0.63167	0.63167	0.48257

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 11 ITEM	TYPE	N	QUIN_M1	QUIN_M2	QUIN_M3	QUIN_M4	QUIN_M5
1	M	1105	0.46606	0.56744	0.75799	0.87395	0.97170
2	M	1105	0.71041	0.88837	0.94977	0.95798	0.98585
3	M	1105	0.62896	0.80000	0.88128	0.90756	0.95755
4	M	1105	0.32127	0.54419	0.69406	0.85294	0.94811
5	M	1105	0.50226	0.73488	0.88584	0.93277	0.98113
6	M	1105	0.58371	0.84651	0.93151	0.98319	1.00000
7	M	1105	0.45701	0.71628	0.86758	0.92437	0.98113
8	M	1105	0.36652	0.52093	0.56621	0.65966	0.76887
9	M	1105	0.20362	0.17674	0.18265	0.28151	0.46698
10	M	1105	0.34389	0.52558	0.78539	0.86555	0.96226
11	M	1105	0.20362	0.31163	0.42922	0.60504	0.90566
12	M	1105	0.40271	0.62791	0.80822	0.89076	0.96698
13	M	1105	0.30769	0.57209	0.72603	0.80672	0.89151
14	M	1105	0.21267	0.34884	0.53881	0.79412	0.94811
15	M	1105	0.22624	0.22791	0.22831	0.28571	0.35377
16	M	1105	0.49321	0.58140	0.54795	0.62185	0.79717
17	M	1105	0.44344	0.55814	0.70320	0.81513	0.91981
18	M	1105	0.28054	0.37674	0.52511	0.57983	0.69811
19	M	1105	0.32579	0.27907	0.41096	0.54622	0.79717
20	M	1105	0.42534	0.57674	0.61187	0.68487	0.80189
21	O	1105	0.27602	0.46512	0.45662	0.68487	1.09434
22	O	1105	1.20362	2.27442	2.54795	2.75210	2.84906
23	O	1105	0.06335	0.13953	0.21005	0.44118	2.06132
24	O	1105	0.19005	0.65581	1.05936	1.52521	2.51887
25	O	1105	0.16742	0.58605	1.20091	2.28151	3.54717
26	O	1105	0.07240	0.28837	0.61644	1.60504	2.60849
27	M	1105	0.42534	0.57209	0.68493	0.72269	0.80660
28	M	1105	0.30769	0.55349	0.65297	0.80672	0.89623
29	M	1105	0.53846	0.86047	0.94977	0.97059	0.96698
30	M	1105	0.23529	0.29767	0.44292	0.66387	0.75472
31	M	1105	0.37104	0.71163	0.86758	0.96218	1.00000
32	M	1105	0.19005	0.28837	0.43379	0.76891	0.90566
33	M	1105	0.28054	0.37674	0.49315	0.51681	0.69811
34	M	1105	0.24434	0.32093	0.46119	0.67647	0.81604
35	M	1105	0.35747	0.65116	0.78082	0.87395	0.94811
36	M	1105	0.29412	0.45116	0.67123	0.88655	0.95755
37	M	1105	0.30769	0.48372	0.67580	0.83613	0.95755
38	M	1105	0.17647	0.10698	0.23744	0.32353	0.56132
39	M	1105	0.31674	0.59535	0.79452	0.90336	0.97642
40	M	1105	0.48416	0.77674	0.91781	0.93277	0.95755
41	M	1105	0.28054	0.42791	0.65753	0.71429	0.85849
42	M	1105	0.31222	0.50698	0.49772	0.69328	0.79717
43	M	1105	0.15385	0.37674	0.58447	0.81092	0.95755
44	M	1105	0.46606	0.71163	0.88584	0.88655	0.95755
45	M	1105	0.19005	0.28372	0.49772	0.59244	0.83019
46	M	1105	0.34389	0.50698	0.66667	0.76050	0.87736

Table 22 (cont'd). Michigan HSPT in Mathematics Pilot
Item Statistics by Form

FORM 11 ITEM	TYPE	N	R_ITT	P_BIS1	P_BIS2	P_BIS3	P_BIS4
1	M	1105	0.42888	0.42888	-0.37329	-0.18272	-0.07729
2	M	1105	0.32279	-0.13025	-0.25640	-0.14422	0.32279
3	M	1105	0.31645	-0.18984	-0.20933	0.31645	-0.11673
4	M	1105	0.48536	0.48536	-0.21620	-0.19414	-0.31497
5	M	1105	0.41567	0.41567	-0.26506	-0.26057	-0.14148
6	M	1105	0.42547	0.42547	-0.32381	-0.19193	-0.16603
7	M	1105	0.44127	-0.17731	0.44127	-0.30640	-0.20361
8	M	1105	0.27294	-0.18454	-0.22143	0.27294	-0.07266
9	M	1105	0.22152	-0.10904	0.22152	-0.15162	0.00642
10	M	1105	0.48465	0.48465	-0.30610	-0.26307	-0.17590
11	M	1105	0.48122	-0.30201	0.48122	-0.13808	-0.19336
12	M	1105	0.45750	-0.24643	0.45750	-0.29732	-0.15805
13	M	1105	0.42399	-0.22787	-0.28485	-0.12720	0.42399
14	M	1105	0.54633	0.54633	-0.25745	-0.30290	-0.21388
15	M	1105	0.10889	0.09217	0.10889	-0.09579	-0.07828
16	M	1105	0.21888	-0.16820	-0.10533	0.21888	-0.08259
17	M	1105	0.37848	-0.21950	-0.21605	0.37848	-0.13937
18	M	1105	0.31000	0.31000	-0.19040	-0.12903	-0.08852
19	M	1105	0.35872	-0.19143	0.35872	-0.19652	-0.06272
20	M	1105	0.26672	0.26672	-0.11203	-0.18696	-0.07450
21	O	1105	0.38449				
22	O	1105	0.56218				
23	O	1105	0.57337				
24	O	1105	0.68154				
25	O	1105	0.75374				
26	O	1105	0.71414				
27	M	1105	0.28064	-0.16586	-0.18010	0.28064	-0.09845
28	M	1105	0.43224	-0.19726	-0.33417	-0.11757	0.43224
29	M	1105	0.41648	-0.21785	0.41648	-0.23274	-0.23272
30	M	1105	0.39766	-0.24030	-0.14802	0.39766	-0.15443
31	M	1105	0.51483	-0.26661	0.51483	-0.33196	-0.20754
32	M	1105	0.53609	-0.27422	0.53609	-0.22954	-0.22842
33	M	1105	0.28070	-0.27671	-0.01134	0.28070	-0.14032
34	M	1105	0.42646	-0.17525	0.42646	-0.24490	-0.16959
35	M	1105	0.45167	-0.22026	-0.31550	0.45167	-0.15731
36	M	1105	0.52152	0.52152	-0.32147	-0.30169	-0.13854
37	M	1105	0.49142	-0.26428	0.49142	-0.27494	-0.18845
38	M	1105	0.31578	0.31578	-0.12747	-0.11039	-0.11350
39	M	1105	0.51087	-0.28857	-0.28245	0.51087	-0.21445
40	M	1105	0.42190	-0.20032	-0.21341	-0.26159	0.42190
41	M	1105	0.41956	-0.22419	-0.21988	-0.18662	0.41956
42	M	1105	0.33317	-0.17767	-0.16859	0.33317	-0.11807
43	M	1105	0.58026	-0.24377	-0.30537	-0.28296	0.58026
44	M	1105	0.40876	-0.22476	-0.23188	0.40876	-0.20090
45	M	1105	0.44435	0.44435	-0.19309	-0.25943	-0.13524
46	M	1105	0.40233	-0.22488	0.40233	-0.23251	-0.17895

Table 24. HSPT in Mathematics Pilot
Mean Interrater Agreement Between First Two Readers

Two-Point items (0-2)

agree	adjacent	nonadjacent
83.9%	14.8%	1.2%

form 4 #4
form 5 #1
form 6 #6
form 7 #1
form 8 #1
form 9 #1
form 10 #4
form 11 #1

Three-Point items (0-3)

agree	adjacent	nonadjacent
80.6%	16.0%	3.3%

form 4 #1
form 4 #3
form 5 #4
form 5 #5
form 6 #3
form 6 #4
form 7 #3
form 7 #4
form 8 #3
form 8 #6
form 9 #4
form 9 #5
form 10 #1
form 10 #6
form 11 #2
form 11 #6

Four-Point items (0-4)

agree	adjacent	nonadjacent
73.4%	21.1%	5.2%

form 4 #5
form 4 #6
form 5 #2
form 5 #6
form 6 #1
form 6 #5
form 7 #5
form 7 #6
form 8 #2
form 8 #5
form 9 #2
form 9 #6
form 10 #2
form 10 #3
form 11 #4
form 11 #5

Five-Point items (0-5)

agree	adjacent	nonadjacent
75.1%	19.2%	5.7%

form 4 #2
form 5 #3
form 6 #2
form 7 #2
form 8 #4
form 9 #3
form 10 #5
form 11 #3

Table 25. HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Agreement between first 2 readers: 1 = agree 3 = nonadjacent
2 = adjacent . = student's response invalid

Form 4

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	235	.	.	.
1	923	90.1	923	90.1
2	82	8.0	1005	98.1
3	19	1.9	1024	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	170	.	.	.
1	877	80.5	877	80.5
2	177	16.3	1054	96.8
3	35	3.2	1089	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	243	.	.	.
1	659	64.9	659	64.9
2	288	28.3	947	93.2
3	69	6.8	1016	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	355	.	.	.
1	810	89.6	810	89.6
2	93	10.3	903	99.9
3	1	0.1	904	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	374	.	.	.
1	560	63.3	560	63.3
2	273	30.8	833	94.1
3	52	5.9	885	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	507	.	.	.
1	608	80.9	608	80.9
2	129	17.2	737	98.0
3	15	2.0	752	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form
Form 5

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	232	.	.	.
1	1026	90.6	1026	90.6
2	103	9.1	1129	99.6
3	4	0.4	1133	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	209	.	.	.
1	872	75.4	872	75.4
2	237	20.5	1109	95.9
3	47	4.1	1156	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	337	.	.	.
1	865	84.1	865	84.1
2	125	12.2	990	96.3
3	38	3.7	1028	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	245	.	.	.
1	918	82.0	918	82.0
2	167	14.9	1085	96.9
3	35	3.1	1120	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	366	.	.	.
1	814	81.5	814	81.5
2	144	14.4	958	95.9
3	41	4.1	999	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	591	.	.	.
1	462	59.7	462	59.7
2	250	32.3	712	92.0
3	62	8.0	774	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 6

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	136	.	.	.
1	828	69.9	828	69.9
2	294	24.8	1122	94.7
3	63	5.3	1185	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	199	.	.	.
1	723	64.4	723	64.4
2	299	26.6	1022	91.1
3	100	8.9	1122	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	342	.	.	.
1	737	75.3	737	75.3
2	151	15.4	888	90.7
3	91	9.3	979	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	264	.	.	.
1	997	94.3	997	94.3
2	53	5.0	1050	99.3
3	7	0.7	1057	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	381	.	.	.
1	805	85.6	805	85.6
2	77	8.2	882	93.8
3	58	6.2	940	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	491	.	.	.
1	610	73.5	610	73.5
2	195	23.5	805	97.0
3	25	9.0	830	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 7

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	91	.	.	.
1	1059	87.2	1059	87.2
2	144	11.9	1203	99.0
3	12	1.0	1215	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	163	.	.	.
1	809	70.8	809	70.8
2	304	26.6	1113	97.4
3	30	2.6	1143	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	371	.	.	.
1	770	82.4	770	82.4
2	156	16.7	826	99.0
3	9	41.0	935	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	281	.	.	.
1	987	96.3	987	96.3
2	37	3.6	1024	99.9
3	1	0.1	1025	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	472	.	.	.
1	671	80.5	671	80.5
2	112	13.4	783	93.9
3	51	6.1	834	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	297	.	.	.
1	768	76.1	768	76.1
2	191	18.9	959	95.9
3	50	5.0	1009	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 8

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	303	.	.	.
1	939	79.4	939	79.4
2	230	19.5	1169	98.9
3	13	1.1	1182	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	263	.	.	.
1	1015	83.1	1015	83.1
2	156	12.8	1171	95.8
3	51	4.2	1222	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	351	.	.	.
1	880	77.6	880	77.6
2	227	20.0	1107	97.6
3	27	2.4	1134	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	225	.	.	.
1	1047	83.1	1047	83.1
2	114	9.0	1161	92.1
3	99	7.9	1260	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	388	.	.	.
1	866	78.9	866	78.9
2	198	18.0	1064	97.0
3	33	3.0	1097	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	353	.	.	.
1	986	87.1	986	87.1
2	109	9.6	1095	96.7
3	37	3.3	1132	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 9

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	111	.	.	.
1	1159	83.1	1159	83.1
2	198	14.2	1357	97.3
3	38	2.7	1395	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	234	.	.	.
1	856	67.3	856	67.3
2	331	26.0	1187	93.3
3	85	6.7	1272	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	394	.	.	.
1	730	65.6	730	65.6
2	286	25.7	1016	91.4
3	96	8.6	1112	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	288	.	.	.
1	857	70.4	857	70.4
2	332	27.3	1189	97.6
3	29	2.4	1218	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	361	.	.	.
1	923	80.6	923	80.6
2	179	15.6	1102	96.2
3	43	3.8	1145	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	566	.	.	.
1	844	89.8	844	89.8
2	85	9.0	929	98.8
3	11	1.2	940	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 10

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	122	.	.	.
1	750	60.1	750	60.1
2	399	32.0	1149	92.1
3	99	7.9	1248	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	339	.	.	.
1	597	57.9	597	57.9
2	276	26.8	873	84.7
3	158	15.3	1031	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	174	.	.	.
1	806	67.4	806	67.4
2	364	30.4	1170	97.8
3	26	2.2	1196	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	249	.	.	.
1	985	87.9	985	87.9
2	132	11.8	1117	99.6
3	4	0.4	1121	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	269	.	.	.
1	735	66.8	735	66.8
2	280	25.4	1015	92.2
3	86	7.8	1101	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	395	.	.	.
1	776	79.6	776	79.6
2	164	16.8	940	96.4
3	38	3.6	975	100.0

Table 25 (cont.'d). HSPT in Mathematics Pilot
Frequency of Interrater Agreement for Constructed-Response Items by Form

Form 11

Constructed-Response 1

INTER1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	130	.	.	.
1	869	78.7	869	78.7
2	224	20.3	1093	99.0
3	11	1.0	1104	100.0

Constructed-Response 2

INTER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	140	.	.	.
1	1005	91.9	1005	91.9
2	85	7.8	1090	99.6
3	4	0.4	1094	100.0

Constructed-Response 3

INTER3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	269	.	.	.
1	837	86.7	837	86.7
2	109	11.3	946	98.0
3	19	2.0	965	100.0

Constructed-Response 4

INTER4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	361	.	.	.
1	591	67.7	591	67.7
2	247	28.3	838	96.0
3	35	4.0	873	100.0

Constructed-Response 5

INTER5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	280	.	.	.
1	738	77.4	738	77.4
2	177	18.6	915	95.9
3	39	4.1	954	100.0

Constructed-Response 6

INTER6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
missing	276	.	.	.
1	776	81.0	776	81.0
2	163	17.0	939	98.0
3	19	2.0	958	100.0

Table 26. Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 4

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	231	18.4	231	18.4
0	348	27.8	579	46.2
1	55	4.4	634	50.6
2	45	3.6	679	54.1
3	575	45.9	1254	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	166	13.2	166	13.2
0	264	21.1	430	34.3
1	193	15.4	623	49.7
2	198	15.8	821	65.5
3	95	7.6	916	73.0
4	147	11.7	1063	84.8
5	191	15.2	1254	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	239	19.1	239	19.1
0	286	22.8	525	41.9
1	352	28.1	877	69.9
2	120	9.6	997	79.5
3	257	20.5	1254	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	352	28.1	352	28.1
0	644	51.4	996	79.4
1	171	13.6	1167	93.1
2	87	6.9	1254	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	370	29.5	370	29.5
0	209	16.7	579	46.2
1	220	17.5	799	63.7
2	167	13.3	966	77.0
3	89	7.1	1055	84.1
4	199	15.9	1254	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	503	40.1	503	40.1
0	359	28.6	862	68.7
1	132	10.5	994	79.3
2	115	9.2	1109	88.4
3	109	8.7	1218	97.1
4	36	2.9	1254	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 5

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	236	17.3	236	17.3
0	397	29.1	233	46.4
1	220	16.1	853	62.5
2	512	37.5	1365	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	209	15.3	209	15.3
0	468	34.3	677	49.6
1	141	10.3	818	59.9
2	81	5.9	899	65.9
3	237	17.4	1136	83.2
4	229	16.8	1365	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	337	24.7	337	24.7
0	743	54.4	1080	79.1
1	86	6.3	1166	85.4
2	27	2.0	1193	87.4
3	30	2.2	1223	89.6
4	25	1.8	1248	91.4
5	117	8.6	1365	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	245	17.9	245	17.9
0	305	22.3	550	40.3
1	477	34.9	1027	75.2
2	112	8.2	1139	83.4
3	226	16.6	1365	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	366	26.8	366	26.8
0	328	24.0	694	50.8
1	99	7.3	793	58.1
2	382	28.0	1175	86.1
3	190	13.9	1365	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	591	43.3	591	43.3
0	289	21.2	880	64.5
1	219	16.0	1099	80.5
2	162	11.9	1261	92.4
3	65	4.8	1326	97.1
4	39	2.9	1368	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 6

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	136	10.3	136	10.3
0	429	32.5	565	42.8
1	169	12.8	734	55.6
2	86	6.5	820	62.1
3	246	18.6	1066	80.7
4	255	19.3	1321	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	199	15.1	199	15.1
0	190	14.4	289	29.4
1	331	25.1	720	54.5
2	358	27.1	1078	81.6
3	113	8.6	1191	90.2
4	45	3.4	1236	93.6
5	85	6.4	1321	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	342	25.9	342	25.9
0	507	38.4	849	64.3
1	135	10.2	984	74.5
2	85	10.4	1069	80.9
3	252	19.1	1321	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	264	20.0	264	20.0
0	429	32.5	693	52.5
1	251	19.0	944	71.5
2	147	11.1	1091	82.6
3	230	17.4	1321	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	381	28.8	381	28.8
0	602	45.6	983	74.4
1	74	5.6	1057	80.0
2	30	2.3	1087	82.3
3	45	3.4	1132	85.7
4	189	14.3	1321	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	516	39.1	516	39.1
0	246	18.6	762	57.7
1	212	16.0	974	73.7
2	347	26.3	1321	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 7

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	102	7.9	102	7.9
0	77	6.0	179	13.9
1	195	15.1	374	29.0
2	917	71.0	1291	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	161	12.5	161	12.5
0	454	35.2	615	47.6
1	370	28.7	985	76.3
2	97	7.5	1082	83.8
3	79	6.1	1161	89.9
4	64	5.0	1225	94.9
5	66	5.1	1291	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	368	28.5	368	28.5
0	436	33.8	804	62.3
1	329	25.5	1133	87.8
2	93	7.2	1226	95.0
3	65	5.0	1291	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	277	21.5	277	21.5
0	263	20.4	540	41.8
1	122	9.5	662	51.3
2	112	8.7	774	60.0
3	517	40.0	1291	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	466	36.1	466	36.1
0	560	43.4	1026	79.5
1	132	10.2	1158	89.7
2	53	4.1	1211	93.8
3	38	2.9	1249	96.7
4	42	3.3	1291	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	292	22.6	292	22.6
0	76	5.9	368	28.5
1	94	7.3	462	35.8
2	158	12.2	620	48.0
3	198	15.3	818	63.4
4	473	36.6	1291	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 8

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	316	21.3	316	21.3
0	413	27.8	729	49.1
1	414	27.9	1143	77.0
2	342	23.0	1485	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	263	17.7	263	17.7
0	268	18.0	531	35.8
1	154	10.4	685	46.1
2	66	4.4	751	50.6
3	117	7.9	868	58.5
4	617	41.5	1485	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	351	23.6	351	23.6
0	526	35.4	877	59.1
1	272	18.3	1149	77.4
2	105	7.1	1254	84.4
3	231	15.6	1485	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	225	15.2	225	15.2
0	190	12.8	415	27.9
1	317	21.3	732	49.3
2	113	7.6	845	56.9
3	512	34.5	1357	91.4
4	22	1.5	1379	92.9
5	106	7.1	1485	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	388	26.1	388	26.1
0	335	22.6	723	48.7
1	97	6.5	820	55.2
2	117	7.9	937	63.1
3	150	10.1	1087	73.2
4	398	26.8	1485	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	353	23.8	353	23.8
0	268	18.0	621	41.8
1	130	8.8	751	50.6
2	84	5.7	835	56.2
3	650	43.8	1485	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 9

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	149	9.9	149	9.9
0	170	11.3	319	21.2
1	202	13.4	521	34.6
2	985	65.4	1506	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	234	15.5	234	15.5
0	403	26.8	637	42.3
1	322	21.4	959	63.7
2	339	22.5	1298	86.2
3	82	5.4	1380	91.6
4	126	8.4	1506	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	394	26.2	394	26.2
0	453	30.1	847	56.2
1	193	12.8	1040	69.1
2	184	12.2	1224	81.3
3	171	11.4	1395	92.6
4	63	4.2	1458	96.8
5	48	3.2	1506	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	288	19.1	288	19.1
0	445	29.5	733	48.7
1	305	20.3	1038	68.9
2	157	10.4	1195	79.3
3	311	20.7	1506	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	361	24.0	361	24.0
0	319	21.2	680	45.2
1	198	13.1	878	58.3
2	128	8.5	1006	66.8
3	500	33.2	1506	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	566	37.6	566	37.6
0	304	20.2	870	57.8
1	187	12.4	1057	70.2
2	154	10.2	1211	80.4
3	181	12.0	1392	92.4
4	114	7.6	1506	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 10

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	122	8.9	122	8.9
0	417	30.4	539	39.3
1	316	23.1	855	62.4
2	339	24.7	1194	87.2
3	176	12.8	1370	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	339	24.7	339	24.7
0	314	22.9	653	47.7
1	215	15.7	868	63.4
2	130	9.5	998	72.8
3	103	7.5	1101	80.4
4	269	19.6	1370	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	174	12.7	174	12.7
0	88	6.4	262	19.1
1	88	6.4	350	25.5
2	466	34.0	816	59.6
3	295	21.5	1111	81.1
4	259	18.9	1370	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	253	18.5	253	18.5
0	314	22.9	567	41.4
1	114	8.3	681	49.7
2	689	50.3	1370	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	269	19.6	269	19.6
0	165	12.0	434	31.7
1	191	13.9	625	45.6
2	203	14.8	828	60.4
3	130	9.5	958	69.9
4	300	21.9	1258	91.8
5	112	8.2	1370	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	395	28.8	395	28.8
0	545	39.8	940	68.6
1	192	14.0	1132	82.6
2	48	3.5	1180	86.1
3	190	13.9	1370	100.0

Table 26 (cont.'d). Michigan HSPT in Mathematics Pilot
Frequency Distribution of Raw Scores for Constructed-Response Items by Form

Form 11

Constructed-response 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	137	11.2	137	11.2
0	558	45.7	695	57.0
1	367	30.1	1062	87.0
2	158	13.0	1220	100.0

Constructed-response 2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	137	11.2	137	11.2
0	29	2.4	166	13.6
1	127	10.4	293	24.0
2	208	17.0	501	41.1
3	719	58.9	1220	100.0

Constructed-response 3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	263	21.6	263	21.6
0	614	50.3	877	71.9
1	220	18.0	1097	89.9
2	35	2.9	1132	92.8
3	27	2.2	1159	95.0
4	22	1.8	1181	96.8
5	39	3.2	1220	100.0

Constructed-response 4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	353	28.9	353	28.9
0	165	13.5	518	42.5
1	308	25.2	826	67.7
2	205	16.8	1031	84.5
3	136	11.1	1167	95.7
4	53	4.3	1220	100.0

Constructed-response 5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	275	22.5	275	22.5
0	288	23.6	563	46.1
1	146	12.0	709	58.1
2	180	14.8	889	72.9
3	72	5.9	961	78.8
4	259	21.2	1220	100.0

Constructed-response 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-	270	22.1	270	22.1
0	443	36.3	713	58.4
1	135	11.1	848	69.5
2	92	7.5	940	77.0
3	280	23.0	1220	100.0

Table 27. Michigan HSPT in Mathematics Pilot Group Descriptive Statistics

Form	Group											
	White			African-American			Female			Male		
#	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
4	33.31	12.36	867	23.67	10.65	142	31.87	12.27	563	31.43	12.93	543
5	31.79	12.60	981	20.88	9.86	150	29.77	12.24	625	30.41	13.17	615
6	33.57	12.46	874	22.27	9.54	177	30.11	12.44	603	32.56	13.09	592
7	33.51	11.80	835	28.11	12.53	174	31.82	11.75	623	32.21	12.74	575
8	34.50	13.09	1004	20.15	9.28	142	31.83	12.91	675	32.83	14.37	692
9	33.15	12.26	1116	20.41	8.06	121	32.40	11.98	702	31.70	13.24	678
10	34.14	11.90	1020	19.52	8.40	86	32.48	11.47	644	32.98	13.47	594
11	33.56	11.43	823	28.63	12.39	128	32.42	10.81	563	32.37	12.65	536

Table 28. Michigan HSPT in Mathematics Pilot
DIF Statistics (Standardized Mean Differences: SMDs) for Gender and Ethnic Group

Gender

				DIF Against Males			DIF Against Females	
Form	# of Items	# of Males	# of Females	SMD≥.20	.19≥SMD≥.10		SMD≤-.20	-.19≤SMD≤-.10
4	46	543	563	0	0	(0)*	0	0
5	46	615	625	0	2	(2)	0	4
6	46	592	603	0	2	(1)	0	1
7	46	575	623	2	1	(2)	0	3
8	46	692	675	2	0	(3)	0	1
9	46	678	702	1	4	(6)	0	0
10	46	594	644	2	4	(4)	0	4
11	46	536	563	1	2	(1)	1	1

Ethnicity

				DIF Against Whites			DIF Against African-Americans	
Form	# of Items	# of Whites	# of African-Americans	SMD≥.20	.19≥SMD≥.10		SMD≤-.20	-.19≤SMD≤-.10
4	46	867	142	0	5	(2)*	1	5
5	46	981	150	1	2	(0)	0	4
6	46	874	177	1	1	(1)	1	2
7	46	835	174	1	2	(1)	0	5
8	46	1004	142	0	5	(3)	1	6
9	46	1116	121	0	4	(2)	1	4
10	46	1020	86	0	4	(2)	2	2
11	46	823	128	0	3	(5)	2	4

* Absolute value of the difference in total "practically significant" DIF across the two groups of a comparison. Total DIF for each group is twice the number of items with |SMD|≥.20 plus the number of items with .10≤SMD≤.19.

Appendix D

Table 31. Student Survey Response Means in Mathematics

By the end of tenth grade, how often did your school experience include:

Statement		Mean
18 *	using experiments and simulations to solve problems involving probability and statistics?	1.31
26 *	creating and using reflections, translations, rotations, and size transformations to analyze relationships among figures to solve problems?	1.43
23 *	constructing and analyzing two- and three-dimensional figures to solve problems?	1.49
25 *	drawing valid conclusions from a set of assumptions to solve problems?	1.57
17	comparing different ways of graphing a set of data?	1.62
12 *	using equations and inequalities to solve real-world problems?	1.64
22 *	visualizing and sketching two and three dimensional figures to solve problems?	1.64
2 *	writing an explanation of how you solved a mathematics problem?	1.68
14	making predictions after examining data?	1.69
7	explaining to others how you solved a problem?	1.72
16	calculating and/or using mean, median and mode to describe a set of data?	1.75
24	drawing a conclusion or determining a pattern from a set of examples?	1.76
20	using recognized characteristics of shapes to make generalizations and to solve problems?	1.83
8	using coordinate points in a plane to determine relationships about geometric shapes and to solve geometric problems?	1.86
27*	using coordinate points in a plane to determine relationships about geometric shapes and to solve geometric problems?	1.88
15	creating a chart, table, or graph from data?	2.04

Table 31 (cont). Student Survey Response Means in Mathematics

Statement		Mean
9	using tables, graphs, and charts to solve problems?	2.13
19	recognizing characteristics of shapes (such as lines, rectangles, and cubes)?	2.17
21	using traditional and metric units of length, perimeter, area, volume, weight, mass, time, and temperature to solve problems?	2.25
13	reading a chart, table, or graph?	2.28
4	doing work with relationships which exist among whole numbers, fractions, decimals, and percents?	2.33
11	solving equations and inequalities like $4x - 34 = 56$ and $3x + 6 < 23$?	2.37
6	studying the meaning of +, -, x, ÷ with whole numbers, fractions, and decimals?	2.38
1	using a calculator to solve problems?	2.41
3	the use and meaning of numbers like 356, $\frac{3}{4}$, 1.78, and 13% (whole numbers, fractions, decimals, and percents)?	2.43
10	using variables in equations and inequalities like $4x - 34 = 56$ and $3x + 6 < 23$?	2.44
5	solving problems using whole numbers, fractions, decimals, and percents?	2.55

*** - more than 10% of students responded "never".**

Table 32. Teacher Survey - Mathematics
Statements with ≥ 50% Schools Responding NSI

(N = 149)

Statement		% of Schools Responding NSI[6]	% of Schools Responding NT[7]
30	Evaluate the quality of an experiment in terms of surveying technique, sampling method, sample size, relevance of the result to the question	72%	55%
33	Evaluate the quality of a simulation (the relevance of the results in terms of the appropriateness of the model and the number of trials necessary to feel confident about a conclusion)	72%	54%
28	Describe and analyze the design of a simple experiment: identify a population, determine survey techniques (census or sample), choose a representative sample, develop appropriate questions to gather data	67%	38%
40	Analyze and describe the effect of parameter changes on the graphs of functions and relations	61%	26%
31	Describe a simple simulation: describe a model, define a single trial, and gather data	60%	38%
32	Interpret results: organize and summarize results, interpret experimental frequencies in the context of the problem, compare results with what is expected (to theoretical probabilities if applicable)	60%	40%
24	Recognize and generalize patterns and deviations from patterns in representations of a data set (examine spread, shape and identify trends)	58%	24%
27	Pose problems, predict outcomes, interpolate, and extrapolate (within that warranted by range of data collected) using representations of data set	56%	26%
29	Interpret and use results: organize and summarize data, use appropriate representations and statistics to draw conclusions	53%	23%

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[6] NSI = Not Sufficient Instruction

[7] NT = Not Taught

Table 32 (cont). Teacher Survey - Mathematics
Statements with ≥ 50% Schools Responding NSI

Statement		% of Schools Responding NSI[8]	% of Schools Responding NT[9]
19	Identify practical situations and solve problems involving quantities as directly proportional, directly proportional as the square, or inversely proportional	52%	9%
25	Determine and/or use measures of central tendency and spread (range, mode, median, mean, quartile, percentile, standard deviation) given a set of data	50%	5%
30	Evaluate the quality of an experiment in terms of surveying technique, sampling method, sample size, relevance of the result to the question	50%	21%
26	Analyze the effects of data transformation on measures of central tendency (mode, median, mean)	50%	21%

---

[8] NSI = Not Sufficient Instruction

[9] NT = Not Taught

Table 33. Teacher Survey - Mathematics
Statements with 0% Schools Responding NT

1. Represent numbers in different ways -- using words, symbols (e.g. numerals, scientific notation), pictures, diagrams, and physical models

*4. Order numbers, make estimates of numbers, and recognize the relative magnitude of numbers

6. Identify and use numbers theory concepts (e.g., primes, factors and multiples)

9. Use mental arithmetic techniques to solve problems with selected whole numbers, fractions, decimals, percents, integers, and square roots

41. Name and use the terms for the component of a figure (e.g., vertex, side, diagonal, angle, etc.)

43. Compute and solve problems related to perimeter, area and volume

45. Solve problems involving measures

46. Use measurement tools

* - the statement has 0% of schools responding NSI as well.

Mathematics
Student Survey

Directions: *Listed below are statements about activities that often take place in mathematics classes. The Michigan Department of Education is interested in finding out how often these activities have been a part of* *your* *school experience by the end of tenth grade.*

Please read each question carefully and answer it the BEST that you can. For each question, darken one circle on your answer sheet labeled Session 1 *to indicate your response using the scale below.*

Scale:	A	B	C	D
	Never	Very Little	Some	A lot

Sample Item:

By the end of tenth grade, how often did your school experience include:

A: using trigonometric ratios to solve problems involving sine and cosine?

By the end of tenth grade, how often did your school experience include:

1. using a calculator to solve problems?
2. writing an explanation of how you solved a mathematics problem?
3. the use and meaning of numbers like 356, $^3/_4$, 1.78 and 13% (whole numbers, fractions, decimals and percents)?
4. doing work with relationships which exist among whole numbers, fractions, decimals and percents?
5. solving problems using whole numbers, fractions, decimals, and percents?
6. studying the meaning of +, -, x, – with whole numbers, fractions and decimals?
7. explaining to others how you solved a problem?
8. using ratios and proportions to solve problems?
9. using tables, graphs, and charts to solve problems?
10. using variables in equations and inequalities like $4x - 34 = 56$ and $3x + 6 < 23$?
11. solving equations and inequalities like $4x - 34 = 56$ and $3x + 6 < 23$?
12. using equations and inequalities to solve real-world problems?
13. reading a chart, table or graph?
14. making predictions after examining data?
15. creating a chart, table or graph from data?

16. calculating and/or using mean, median, and mode to describe a set of data?
17. comparing different ways of graphing a set of data?
18. using experiments and simulations to solve problems involving probability and statistics?
19. recognizing characteristics of shapes (such as lines, rectangles and cubes)?
20. using recognized characteristics of shapes to make generalizations and to solve problems?
21. using traditional and metric units of length, perimeter, area, volume, weight, mass, time, and temperature to solve problems?
22. visualizing and sketching two and three dimensional figures to solve problems?
23. constructing and analyzing two and three dimensional figures to solve problems?
24. drawing a conclusion or determining a pattern from a set of examples?
25. drawing valid conclusions from a set of assumptions to solve problems?
26. creating and using reflections, translations, rotations, and size transformations to analyze relationships among figures to solve problems?
27. using coordinate points in a plane to determine relationships about geometric shapes and to solve geometric problems?

Thank you very much!

MICHIGAN HIGH SCHOOL PROFICIENCY TEST IN MATHEMATICS

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